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SUPPLEMENT 145

STUDIES ON VEGETABLE SEED TREATMENTS IN 1943

March 15, 1944

STUDIES ON VEGETABLE

SEED TREATMENTS IN 1943

Plant Disease Reporter
Supplement 145 March 15, 1944

This series of articles constitute the 1943 report of the Vegetable Seed Treatment Subcommittee of the Seed Treatment Committee to the American Phytopathological Society. The reports by Drs. Koehler and Semeniuk report work done independently of the vegetable committee but are included herein for the convenience of the readers in assembling the various reports.

STUDIES ON VEGETABLE SEED TREATMENTS IN 1943

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I. SCOPE OF THE 1943 TESTS

George L. McNew

Series of uniform seed treatment tests were made with 13 vegetable crops during 1943. A total of 233 sets of seed were distributed to 60 cooperators in 34 States, and in 2 Provinces of Canada, as shown in Table 1. Each set consisted of 5 replications of 100 seeds each from various treated lots prepared by the crop leaders. All the seed of each crop was from the same stock except for potatoes and sweetpotatoes, of which each cooperator treated his own stock according to standard procedures.

The tests were set out according to a fixed plan at the appropriate date in each locality, and the data were subjected to analysis of variance according to the same procedure; so the variations in results reported are mainly attributable to differences in environmental conditions. The reports offer considerable data on the severity of seed decay and damping-off in different localities, the value of different fungicides, and the minimum effective dosages that can be employed under different environmental conditions.

Considerable emphasis was placed on the rate of application because the use of different dosages is a preferred method of evaluating fungicides. Furthermore, the information obtained can be of great service in making effective use of existing supplies of fungicides. In all reports, the rate of application has been expressed as percentage by weight. This was considered necessary to avoid the confusion and misinterpretaion that has developed from using different standards such as those in vogue (percentages, oz. per 15 lb., or oz. per bushel). The bushel measure is so variable that it particularly is to be condemned and should be discarded in expressing rates. Where confusion is likely to result from use of percentages, the rate in ounces per bushel has been put in parentheses at some point in each report.

Number of Cooperative Seed Treatment Trials Made During 1943
Table 1

Test to be made No.	State	Name of cooperators	A	B	C	D	E	F	G	H	I	J	K	L	M	Total
			Number of Tests on Crops[a]													
01	Cal.	L. D. Leach		1	1		1	1	1							5
02	Conn.	J. G. Horsfall & A. D. McDonnell	1	1			1									3
03	Conn.	A. M. Porter					1									1
04	Del.	J. W. Heuberger			1											1
05	Del.	S. L. Hopperstead					1									1
06	Fla.	A. L. Harrison	1	1	1		1		1			1				6
07	Fla.	A. N. Brooks					1									1
08	Fla.	G. W. Townsend			1											1
09	Fla.	W. B. Tisdale					1									1
10	Ga.	W. D. Moore		1	1		1	1		1						5
11	Ga.	G. E. Thompson				1	1		1			1				4
12	Idaho	G. Ken Knight		1			1					1				3
13	Ill.	M. B. Linn	1	1	1		1	1	1	1	1		1			9
14	Ind.	R. M. Caldwell				1										1
15	Ind.	R. W. Sampson									2					2
16	Ind.	G. M. Smith and A. J. Ullstrup	1													1
17	Iowa	R. H. Porter and W. N. Rice	1	2	2	1	1	1		1			2			11
18	Maine	Reiner Bonde		1												1
19	Maine	Reiner Bonde and R. M. Bailey	2													2
20	Md.	C. E. Cox					1									1
20.1	Md.	S. P. Doolittle and F. S. Beecher							2				2			4
21	Mass.	O. C. Boyd and Thos. Sproston									1					1
22	Mass.	E. F. Guba and O. C. Boyd	1	1	1		1	1				1		1		7
23	Mass.	C. V. Kightlinger									1					1
24	Mich.	J. H. Muncie		1		1	1	1	1	1			1			7
25	Minn.	R. S. Davidson and C. J. Eide									3					3

[a] Crops tested:

A. Sweet corn
B. Peas
C. Lima Beans
D. Soybeans
E. Spinach
F. Beets
G. Tomatoes
H. Onion
I. Potato
J. Snap beans
K. Cucumber
L. Sweetpotato
M. Carrot

No.	State	Name of cooperators	A	B	C	D	E	F	G	H	I	J	K	L	M	Total
26	Minn.	C. J. Eide	1	1	1		1									4
27	Minn.	I. W. Tervet				1										1
28	Miss.	J. A. Pinckard	3	3	3		1				2	3				15
29	Mo.	C. M. Tucker				1										1
30	Neb.	J. E. Livingston and M. W. Felton	1	1							1					3
31	N. J.	C. M. Haenseler	1	1	1		1						1			5
32	N. Y.	H. H. Campbell					1									1
33	N. Y.	H. S. Cunningham	1	1	1		1									4
34	N. Y.	A. A. Foster	1	1	1	1	1	1	1							7
35	N. Y.	F. M. Gordon	1		1		1		1							4
36	N. Y.	G. L. McNew	2	3	2	1	2	1	2	1	1	1	1		2	19
37	N. Y.	A. G. Newhall								1						1
38	N. C.	D. E. Ellis					1									1
39	N. D.	W. E. Brentzel					1									1
40	Ohio	J. D. Wilson	1	2	1	1	1	1								7
41	Okla.	J. H. McLaughlin	1		1		1									3
42	Okla.	J. H. McLaughlin and H. B. Cordner									1					1
43	Okla.	J. H. McLaughlin and H. Graumann				1										1
44	Pa.	W. S. Beach	1	1	1	1	1	1	1			1	1			9
45	R. I.	F. L. Howard	1			1	1				1					4
46	S. C.	C. N. Clayton	1	1	1	1	1				1					6
47	S. C.	C. J. Nusbaum	1	1	1	1	1					1		1		7
48	S. D.	W. F. Buchholtz	1	1			1	1								4
49	Tenn.	C. D. Sherbakoff and R. A. Hyre	1			1	1									3
50	Tex.	G. H. Godfrey					1									1
51	Va.	R. P. Porter		1	1	1	1					2		1		7
52	Wash.	C. J. Gould	1	1	1		1	1	1	1		1				8
53	Wash.	C. J. Gould and T. E. Randall									1					1
54	Wash.	L. K. Jones	1	1		1		1	1							5
55	W. Va.	J. G. Leach	1		1	1	1									4
56	Wis.	J. G. Dickson	1			1										2
57	Wis.	J. C. Walker		1	1		1			1		1				5
58	Wyo.	G. H. Starr	1	1	1		1				1					5
59	Canada	Irene Mounce and J. E. Bosher					1			1						2
60	Canada	G. A. Scott		1			1									2
		Total Number	32	34	29	19	42	13	14	10	16	14	9	2	3	237

The fungicides tested on one or more crops were:

Arasan (50% tetramethyl-thiuram-disulfide manufactured by the Bayer-duPont Company)
Bichloride of mercury (mercuric chloride, corrosive sublimate)
Borax (sodium tetraborate manufactured by the Pacific Coast Borax Company)
Catex (an impure phenol secured by the destructive distillation of pine wood by the Southern Pine Chemical Company)
New Improved Ceresan (5% ethyl mercury phosphate manufactured by Bayer-duPont Company)
2% Ceresan (2% ethyl mercury chloride manufactured by the Bayer-duPont Company)
Copper sulfate (blue vitriol crystals with 25% copper equivalent)
Fermate (70% ferric dimethyl-dithio-carbamate manufactured by the Grasselli Chemical Division of E. I. duPont Company)
Formaldehyde-40% solution
Semesan (30% hydroxymercurichlorophenol manufactured by the Bayer-duPont Company)
Semesan Jr. (1% ethyl mercury phosphate manufactured by the Bayer-duPont Company)
Semesan Bel (12% hydroxymercurinitrophenol and 2% hydroxymercurichlorophenol manufactured by the Bayer-duPont Company)
Spergon (98% tetrachloro-para-benzoquinone manufactured by the U. S. Rubber Company)
Thiosan (same as Arasan except for incorporation of a wetting agent)
Yellow cuprocide (83% yellow cuprous oxide manufactured by the Rohm and Haas Company)
Yellow oxide of mercury (mercuric oxide)
Zinc oxide (AAZ special manufactured by Rohm and Haas or Vasco 4 by Virginia Smelting Company).

Several new lines of study were undertaken by the Committee in 1943. Preliminary tests on seed disinfectants were initiated. Seed treatments as substitutes for soil disinfestants, such as formaldehyde for controlling onion smut, have been so promising that they were placed in the cooperative tests. The critical studies on the value of potato seed-piece treatment were continued another year to determine if they were of dubious value as indicated by the 1942 tests. Preliminary studies were begun with fungicides for soybean seed. Considerable effort was devoted to a study of the possibility of securing pre-treatment of vegetable seed by seedsmen before distribution to the growers. Since this latter activity is more of an extension function than research, its activities were later incorporated into the program of the Fungicide Sub-committee of the War Committee, but it may well be included in this report since it is largely based on the research activities of the Vegetable Seed Treatment Committee.

It is hoped that members of the American Phytopathological Society and their fellow scientists can make use of this report in meeting war-time conditions. If occasion demands citation of the data, due credit should be given to the appropriate crop leader for preparation of summaries and to the particular cooperators who collected specific data and made these

studies possible. The leaders responsible for the different reports are as follows: sweet corn, C. M. Haenseler; peas, George L. McNew; lima and snap beans, J. C. Walker; soybeans, R. H. Porter; spinach, R. P. Porter; beets, L. D. Leach; tomatoes and cucumbers, S. P. Doolittle; onions, A. G. Newhall; potato, C. N. Clayton; sweetpotato, C. J. Nusbaum; and contact with seedsmen, R. H. Porter and W. F. Crosier.

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II. SWEET CORN SEED TREATMENTS

C. M. Haenseler

Emergence data were obtained in 31 standardized tests conducted in 31 localities in 23 States on a commercial lot of Golden Cross Bantam sweet corn agitated for 15 minutes with different chemicals. The treatments applied were Semesan Jr. at 0.1875% by weight; Arasan at 0.0937%, 0.1875%, and 0.3750%; and Spergon at 0.0937%, 0.1875%, and 0.375%.

A total of 500 seeds of each of these treated lots and an untreated check were planted in 5 randomized replications of 100 seeds each. Counts were taken on total number of seedlings emerged. Records on the number of weak seedlings was obtained in 13 of the 31 tests.

All tests were made under field conditions. A record of the environmental conditions prevailing in each test is given in Table 2. Data on seedling emergence and the statistical significance of these data are recorded in Table 3.

The number of tests in which seedling emergence for one treatment was significantly better than for each other treatment, and the relative value of the several treatments are presented in Table 4.

In eighteen (58%) of the 31 tests conducted in 1943, the total emergence counts showed statistically significant differences (at 5% level) between treatments when the data were analyzed by Fisher's method for the analysis of variance for a randomized block experiment. Based on analysis of these 18 significant tests the results may be summarized as follows:

1. Treated seed gave significantly higher germination rates in all except 2 out of a total of 126 possible comparisons.

2. Arasan and Spergon gave significant increases in germination in a larger number of cases than did Semesan Jr. used at the same dosage.

3. In each of 3 dosages used, Arasan gave increased germination somewhat more frequently than did Spergon.

4. Both Arasan and Spergon gave progressively better seed protection as the dosage rates were increased from .0937% to .187% and to .375%.

5. "Weak seedling" counts made in 13 tests showed the largest total number of weak seedlings from untreated seed, and the lowest number in the .375% Arasan treatment which gave the highest total emergence. Thus the largest number of weak seedlings occurred where the total germination was poorest and vice versa. This would indicate definitely that greater benefits may be derived from seed treatments than are shown in the "total emergence" figures ordinarily used in evaluating seed protectants.

6. Yields were obtained in only one test. In this test .375% Arasan-

Table 2. Location, time, and environmental conditions for 31 cooperative sweet corn tests conducted in 1943.

Report from		Planting	Soil condition			Germ. period[b]		Days to
Test no.	State	date	pH	Moisture	Soil type	Rainfall	Air temp. °F. Min. Max.	emerge[a]
						In.		
13	Ill.	5/14	7.2	Opt.	Clay loam	3.92	49-63	11
16	Ind.	4/19	--	Dry	Sandy	1.43	44-65	16
17-1	Iowa	4/16	7.0	Opt.	Clay loam	--	--	--
19-2	Maine	5/28	6.8	Wet	Loam	1.86	44-66	--
22	Mass.	5/4	6.0	Wet	Sandy loam	2.42	46-69	13
28-2	Miss.	4/2	6.7	Wet	F. sandy loam	.75	56-81	6
30	Neb.	5/5	5.6	V.wet	Clay loam	2.66	44-62	11
31	N.J.	7/16	5.8	Opt.	Loam	.13	65-88	5
35	N.Y.	5/10	--	Dry	Sandy loam	4.59	54-68	14
36-2	N.Y.	6/29	7.0	Opt.	Silt loam	1.63	60-83	--
44	Pa.	6/4	6.8	Dry	Clay loam	.55	61-80	7
46	S.C.	3/16	5.0	Opt.	Sandy loam	2.10	47-70	9
48	S.D.	5/8	6.5	Opt.	Sandy loam	1.98	43-68	19
49	Tenn.	4/29	5.6	Opt.	Silt loam	1.21	56-81	8
52	Wash.	5/27	5.7	Opt.	Sandy loam	1.07	43-68	--
54	Wash.	5/7	7.2	Wet	Loam	.72	39-59	--
55	W.Va.	5/26	7.4	Wet	Clay loam	Note[c]	70-78[c]	8
58	Wyo.	5/4	7.5	Opt.	Sandy loam	.72	38-53	23
2	Conn.	3/16	5.2	Wet	F. sandy loam	W. daily	54-80	7
6	Fla.	3/18	7.0	Opt.	F. loamy sand	.80	56-80	8
19-1	Maine	6/8	6.5	Opt.	F. sandy loam	1.26	49-75	14
26	Minn.	5/3	5.7	Dry	Silt loam	2.34	39-63	17
28-1	Miss.	4/12	5.7	Opt.	Ochlockonee	.87	54-79	8
28-3	Miss.	4/6	--	Dry	Silt loam	.84	55-73	13
33	N.Y.	5/28	5.1	Opt.	Loam	1.58	59-81	5
36-1	N.Y.	6/15	7.0	Opt.	Silt loam	1.74	63-88	--
40	Ohio	5/14	6.5	Opt.	Silt loam	2.27	49-67	--
41	Okla.	4/7	6.8	Dry	Loam	1.08	48-73	10
45	R.I.	5/13	6.2	Wet	V.F.Fine	1.32	45-65	9
47	S.C.	4/26	5.5	Opt.	Sandy loam	.17	57-82	7
56	Wis.	5/28	--	Opt.	Silt loam	1.13	58-72	10

a -- "Days to emerge" was taken as time between planting and time when majority of seedlings emerged.

b -- For sake of uniformity in recording precipitation and temperatures, the germination period was arbitrarily considered as 50% longer than "days to emerge".

c -- Two heavy rains during germination period. Temperature data on last half of germination period only.

Table 3. Summary of cooperative sweet corn seed treatment tests analyzed as randomized block tests -- 1943

Report from: Test no.	Report from: State	Average number of seedlings emerged from: Semesan Jr. .1875 %	Arasan used at .0937 %	Arasan used at .1875 %	Arasan used at .375%	Spergon used at .0937 %	Spergon used at .1875 %	Spergon used at .375%	Untreated	Diff. req. sign.	Calc. "F" value
13	Ill.	63.2	69.2	66.8	73.0	70.6	68.4	72.0	52.2	7.10	7.47
16	Ind.	85.0	87.8	91.2	93.6	86.4	90.4	90.4	79.8	5.35	5.59
17-1	Iowa	81.0	85.8	84.0	84.2	82.4	80.0	86.4	77.4	4.65	3.65
19-2	Maine	83.4	84.8	89.2	83.8	85.8	86.0	84.4	78.2	5.03	3.19
24	Mass.	86.6	90.6	91.2	89.0	86.6	87.8	85.6	85.2	4.16	2.44
28-2	Miss.	75.6	81.4	70.8	75.0	75.8	77.4	80.0	68.8	7.78	2.49
30	Neb.	47.4	57.6	56.0	65.6	49.2	61.2	56.4	37.6	10.12	6.11
31	N.J.	83.0	81.8	80.6	82.8	83.8	83.6	85.8	77.2	4.94	2.62
35	N.Y.	73.6	78.4	82.4	79.8	79.8	76.6	80.4	65.6	7.52	4.24
36-2	N.Y.	86.6	87.8	86.8	85.4	81.2	82.6	82.8	79.0	5.16	3.03
44	Pa.	88.0	85.2	85.4	85.6	86.6	87.0	87.0	79.8	4.35	2.82
46	S.C.	74.8	84.0	86.6	87.2	83.0	79.6	83.4	80.0	5.80	4.14
48	S.D.	87.0	82.4	85.0	89.6	80.0	81.2	84.4	85.0	5.32	2.79
49	Tenn.	80.4	77.4	85.6	87.2	77.6	83.0	85.2	77.2	5.78	4.21
52	Wash.	80.8	77.0	71.4	66.8	82.0	86.4	83.6	80.8	9.37	4.11
54	Wash.	68.0	71.8	76.0	76.6	73.8	73.4	75.2	50.0	7.33	11.93
55	W.Va.	79.6	82.8	84.8	85.8	77.2	79.6	76.0	74.8	6.60	3.18
58	Wyo.	36.0	29.6	35.8	39.2	30.6	35.8	39.6	25.2	7.65	3.62
2	Conn.	84.8	88.0	89.2	90.8	86.4	87.0	88.4	82.4	N.S.	1.48
6	Fla.	84.4	83.0	80.0	80.4	79.4	79.8	79.2	75.6	N.S.	2.32
19-1	Maine	75.4	79.6	83.0	82.4	79.4	83.6	81.2	75.8	N.S.	1.85
26	Minn.	63.2	72.6	68.6	76.0	73.6	67.6	76.4	66.0	N.S.	2.35
28-1	Miss.	57.8	64.0	68.2	71.4	62.2	60.4	63.2	66.6	N.S.	1.36
28-3	Miss.	78.6	71.8	79.4	78.0	81.6	80.4	79.6	74.6	N.S.	1.16
33	N.Y.	89.2	88.8	91.6	93.2	91.4	87.8	91.0	86.6	N.S.	2.27
36-1	N.Y.	67.6	73.0	72.2	70.0	67.2	71.4	67.4	61.8	N.S.	1.61
40	Ohio	86.4	85.2	86.8	84.4	86.4	85.6	86.8	86.0	N.S.	0.38
41	Okla.	82.2	83.4	81.6	82.4	80.8	81.4	79.2	77.4	N.S.	0.74
45	R.I.	79.8	82.8	82.4	81.4	80.6	80.0	80.4	75.6	N.S.	0.80
47	S.C.	66.2	73.2	71.0	71.4	66.0	67.2	69.6	71.0	N.S.	0.74
56	Wis.	82.4	86.6	84.2	84.4	84.0	86.0	85.8	86.8	N.S.	0.67

Table 4. Number of tests in which seedling emergence for one treatment was significantly better than that for each other treatment in 18 of the 31 tests (Maximum score = 126)

Column 1	Number of times treatment in Column 1 was better than:								Score of treatment
	Semesan Jr. .1875%	Arasan used at .0937 %	Arasan used at .1875 %	Arasan used at .375%	Spergon used at .0937 %	Spergon used at .1875 %	Spergon used at .375%	Untreated check	
Semesan Jr. .1875%	---	0	0	1	2	1	0	8	12
Arasan .0937%	3	---	1	1	1	2	2	12	22
Arasan .1875%	5	2	---	1	4	1	2	14	29
Arasan .375%	6	4	0	---	6	2	1	14	33
Spergon .0937%	2	0	1	1	---	0	0	9	13
Spergon .1875%	2	1	1	1	1	---	0	11	17
Spergon .375%	4	2	3	1	2	1	---	12	25
Untreated check	0	0	1	1	0	0	0	---	2

treated seed gave highest germination and highest yield, and all of the treatments except Semesan Jr. gave significantly higher yields than did the untreated seed.

7. In one test where height of plants at tassel time was taken, no significant difference in average plant height was shown as a result of the seed treatments.

III. PEA SEED TREATMENTS

George L. McNew

Sufficient pea seed of the variety Thos. Laxton was treated to provide 5 replications of 100 seeds from each treatment for 32 tests by 28 co-operators in 23 States and in 2 Provinces of Canada. The seed was treated by rotation in a half-filled glass container on a vertical turntable for 15 minutes with Spergon, Arasan, or Fermate at 0.34% (3 ounces per bushel), 0.17%, and 0.08% by weight. These 9 treatments and an untreated control were used in all tests.

Two orientation tests were made under greenhouse conditions: one in steamed soil and another in steamed soil artifically infested with Pythium ultimum. Emergence records were taken 38 days after the seed was sown. At that time the plants were cut off at the ground line, dried to constant weight at 105°C., and weighed. Records on the amount of chemical applied to the seed and the results of these 2 tests are given in Table 5.

Table 5. Effect of seed treatments on the emergence and growth of peas in steamed and Pythium-infested soil[a]

Treatment applied to seed: Material	Rate	Weight of materials: Untr. seed	Chemical[b]	Treated seed	Emergence in: Steamed soil	Infested soil	Dry wt. plants: Steamed soil	Infested soil
	%	Gm.	Gm.	Gm.	%	%	Gm.	Gm.
Spergon	.335	4500.1	15.08	4514.2	98.0	95.2	18.12	17.44
Spergon	.168	4500.0	7.54	4507.3	97.8	96.8	17.26	16.46
Spergon	.084	4500.1	3.78	4504.1	97.4	94.2	17.48	16.50
Arasan	.335	4500.0	15.08	4515.1	98.2	87.2	16.64	16.26
Arasan	.168	4500.1	7.54	4507.0	96.6	91.4	17.22	15.08
Arasan	.084	4500.0	3.78	4503.5	97.4	94.8	15.92	16.70
Fermate	.335	4500.0	15.08	4514.2	97.6	90.4	16.02	16.06
Fermate	.168	4500.1	7.54	4506.5	96.8	87.6	16.76	14.02
Fermate	.084	4500.0	3.78	4503.8	97.2	89.8	16.54	15.24
None	---	4500.0	---	4499.6	96.4	78.6	16.20	13.14
Sign. Diff. at 5% Point					N.S.	3.0	N.S.	.55

[a]These 2 tests are referred to as 36a and 36b in subsequent tables.
[b]A slight excess over calculated amount was used in order to secure full dosages.

Apparently none of the treatments injured the seed appreciably since about 97% emergence was secured from all lots sown in steamed (disease-free) soil. There was no significant difference in the average dry weight of plants in steamed soil, but there was definite indication that all 3 Spergon-treated lots produced heavier plants. In Pythium-infested soil, all 9 treatments produced significant increases in emergence and yield of dry plant tissue. The materials rated in the order Spergon, Arasan, and Fermate. There was no significant dosage response even though Fermate appeared slightly less effective at the lower dosages.

The seed lots distributed to cooperators were sown in randomized blocks under a variety of field conditions as shown in Table 6. The conditions were typical of the locality in all except 2 or 3 tests where seed were sown in greenhouses or watered. In all other tests the seed was sown at the usual planting date under ordinary circumstances.

Emergence varied widely in the different localities with untreated seed producing between 8.0 and 90.6% of a stand. One or more treatments produced a significant increase in emergence in 22 (69%) of the 32 tests as shown by the records in Table 7. On the average of all tests, emergence was increased from 71% in the checks to 86% in the better treatments. The average emergence in the 22 tests with significant differences was only slightly less for the better treatments, but the untreated controls had dropped to 65.6% emergence.

A comparison of the various tests show wide variations in results, but the general averages for the 9 treatments agree very closely with the results obtained in the orientation tests. Very few of the field tests showed definite dosage response curves, but in 1 or 2 instances where seed decay was severe (test 02) the heavier applications were definitely superior. Spergon appeared to be more effective than the 2 organic sulfur compounds since it produced an average emergence in the significant tests that was 1 to 4% better than Arasan and 6 to 8% better than Fermate. The relative value of the various treatments perhaps can best be summarized by the number of times that they were reported significantly better than some other treatment or the controls. Such data, abstracted from Table 7, have been summarized in Table 8. The margin of safety for these 3 organic treatments is amply attested by the failure of the untreated seed to score on any of the treated lots in any of the 22 tests used in compiling Table 8. On the other hand, the treated lots produced significant improvement in 160 instances. Spergon's margin of superiority when used at 0.35% (3 oz. bu.) and 0.17% (1.5 oz.) is definitely shown by the scores of 69 and 68 as compared to 63 for Arasan at 0.35% and 31 for Fermate at 0.35%. A more critical comparison probably could be obtained from examining the number of times some other treatment excelled them by a significant margin. As shown in the bottom line of Table 8, Spergon at the 2 higher dosages was scored upon only 3 and 2 times, respectively.

There would seem to be little practical advantage in using more than 0.17% of Spergon (1.5 oz./bu.) by weight since the benefits from heavier rates under average conditions would not justify the additional expense. Under some conditions (tests 02, 51), however, the heavier application is worthwhile. The heavier doses of Arasan and Fermate seem to be warranted under average conditions. As a matter of fact, heavier rates for Fermate were quite essential in many tests.

Table 6. Location, time, and envoronmental conditions for 32 cooperative pea seed treatment tests conducted in 1943

Report from: Test no.	State	Planting date	Soil conditions at planting time: Soil type	pH	Moisture	Rainfall	Air temperature Max.	Air temperature Min.	Days to emerge
						In.	°F.	°F.	
01	Calif.	2/16	Sandy loam	7.1	Opt.	0.60	66	44	--
02	Conn.	3/30	Fine sandy loam	5.2	Wet	Water	86	61	6
06	Fla.	1/29	Sandy loam	6.5	Opt.	---	79	55	8-10
10	Ga.	2/1	Sandy loam	5.2	Opt.	1.00	70	43	12
12	Idaho	5/21	Sandy loam	6.9	Opt.	0.05	66	44	9-12
13	Ill.	5/13	Clay loam	6.2	Opt.	2.55	57	46	6
17a	Iowa	4/8	Clay loam	--	Opt.	---	--	--	12
17b	Iowa	--	Silt loam	--	Moist	Water	50	--	--
22	Mass.	4/28	Grav.S. loam	5.9	Wet	3.07	64	40	15
24	Mich.	5/7	Sandy loam	--	---	2.94	61	43	--
26	Minn.	4/23	Silt loam	5.7	Opt.	0.83	60	38	20
28a	Miss.	2/24	Fine sandy loam	6.7	---	4.25	57	34	19
28b	Miss.[a]	2/13	Silt loam	5.4	Opt.	0.77	60	39	12-14
30	Nebr.	4/2	Clay loam	7.2	---	1.03	66	41	14
31	N.J.	7/16	Loam	5.6	Opt.	0.09	88	66	8
33	N.Y.	3/27	Loam	5.1	Opt.	2.56	49	33	26
34	N.Y.	4/24	Sandy loam	6.5	Wet	0.21	63	45	11
36a	N.Y.	1/27	Sterile compost	6.8	Opt.	Water	75	60	9
36b	N.Y.	1/20	Infested compost	6.9	Opt.	Water	75	60	9
40a	Ohio	4/29	Muck	5.5	Opt.	1.42	65	50	11
40b	Ohio	4/24	Silt loam	6.5	Wet	0.93	60	36	11
40.1	Oreg.[a]	3/9	Clay loam	6.0	Wet	0.45	55	35	15
44	Pa.	4/27	Clay loam	6.9	---	0.61	55	38	8
46	S.C.	1/27	Sandy loam	5.1	Opt.	2.59	63	40	16
47	S.C.	3/11	Sandy loam	5.8	Opt.	0.11	74	52	6
48	S.D.	4/24	Sandy loam	6.5	Dry	0.94	65	38	30
51	Va.	3/2	Sandy loam	5.8	Opt.	1.99	59	37	18
52	Wash.	4/24	Sandy loam	6.0	Opt.	0.50	64	36	--
54	Wash.	5/5	Loam	7.2	Opt.	0.95	55	37	16
57	Wis.	4/21	Silt loam	6.5	Opt.	0.99	65	44	14
58	Wyo.	4/29	Sandy loam	7.5	---	0.72	54	38	26
60	Canada	6/10	Sandy loam	7.5	Opt.	1.27	75	53	6

a -- 28b test made by H. H. Foster; 40.1 test made by P. W. Miller and F. P. McWhorter

Table 7. Effect of seed treatments on emergence of Thos. Laxton peas (table concluded on next page)

Report from		Emergence from seed treated with					
Test	Local-	Spergon at rate of			Arasan at rate of		
no.	ity	.335%	.168%	.084%	.335%	.168%	.084%
		%	%	%	%	%	%
01	Calif.	87.4	87.2	85.2	86.2	82.0	85.0
02	Conn.	80.0	66.8	61.2	72.4	56.4	49.4
06	Fla.	88.4	89.0	89.2	72.4	79.0	68.4
10	Ga.	72.8	71.6	71.8	70.8	64.6	73.6
13	Ill.	91.2	96.0	94.6	93.4	93.2	94.8
17a	Iowa	83.2	90.6	91.2	89.0	85.8	93.4
17b	Iowa	91.0	90.8	74.0	91.2	84.5	75.2
22	Mass.	90.2	93.6	88.2	93.4	93.8	90.2
24	Mich.	83.2	84.8	82.6	81.2	79.4	80.2
26	Minn.	91.2	92.8	93.4	95.8	92.0	88.8
31	N.J.	76.4	70.8	79.0	76.0	58.4	80.2
33	N.Y.	83.6	81.6	82.6	85.0	80.8	79.4
34	N.Y.	85.4	83.6	78.0	84.0	82.6	80.6
36b	N.Y.	95.2	96.8	94.2	87.2	91.4	94.8
40a	Ohio	87.6	83.2	81.8	86.8	77.8	77.2
40b	Ohio	89.2	88.6	91.0	91.8	88.4	87.0
40.1	Oreg.	81.2	87.6	86.0	89.6	87.6	86.8
44	Pa.	92.8	91.8	90.2	91.4	91.4	89.8
51	Va.	71.8	67.2	62.8	53.2	45.0	39.4
52	Wash.	83.2	85.2	78.2	78.8	77.6	75.8
54	Wash.	90.4	87.4	90.2	89.4	89.2	89.6
57	Wis.	84.2	82.2	82.6	90.0	82.0	83.4
Av. (Sign.)		85.4	85.0	83.1	84.0	80.1	80.1
12	Idaho	84.4	87.2	84.8	88.0	83.4	86.8
28a	Miss.	75.0	66.8	75.8	69.6	65.8	63.6
28b	Miss.	91.0	91.2	86.2	89.2	90.6	88.6
30	Nebr.	83.2	89.6	91.0	93.2	92.0	88.2
36a	N.Y.	98.0	97.8	97.4	98.2	96.6	97.4
46	S.C.	87.6	82.0	82.4	85.4	74.4	84.4
47	S.C.	94.6	95.6	95.8	94.8	97.2	95.0
48	S.D.	79.2	79.4	78.2	82.8	81.4	83.6
58	Wyo.	91.8	91.4	90.4	97.6	91.2	92.8
60	Canada	95.0	94.5	92.5	90.0	93.0	89.0
Av. (Not sign.)		88.0	87.6	87.4	88.9	86.6	86.9
GRAND AV.		86.2	85.8	84.0	85.6	82.1	82.3

Table 7. Effect of seed treatments on emergence of Thos. Laxton peas.
(Concluded from preceding page)

Report from Test no.	Report from Locality	Emergence from seed treated with Fermate at rate of .335%	.168%	.085%	Untreated check	Diff. req. sign.	Calc. F value
		%	%	%	%	%	
01	Calif.	83.6	83.6	82.8	76.2	6.4	2.12
02	Conn.	53.6	51.8	36.2	8.0	9.9	34.20
06	Fla.	81.2	81.4	66.0	60.8	12.0	6.02
10	Ga.	72.0	71.4	75.2	67.4	5.2	2.81
13	Ill.	90.8	88.6	86.4	83.6	4.1	7.94
17a	Iowa	91.4	89.8	87.4	71.4	9.6	3.58
17b	Iowa	86.8	79.5	78.2	49.8	10.9	8.7
22	Mass.	88.0	87.8	82.6	69.6	6.5	10.22
24	Mich.	72.0	74.0	70.2	49.4	12.8	5.56
26	Minn.	93.4	90.4	93.2	90.6	3.1	3.33
31	N.J.	76.4	79.0	62.0	62.2	13.2	2.98
33	N.Y.	81.0	75.0	75.0	64.4	5.4	10.42
34	N.Y.	73.2	73.6	70.6	61.6	7.9	7.52
36b	N.Y.	90.4	87.6	89.8	78.6	3.0	5.61
40a	Ohio	71.6	74.6	70.4	66.4	6.5	9.77
40b	Ohio	88.8	83.8	82.8	73.0	5.8	7.46
40.1	Oreg.	81.8	81.8	81.8	75.0	8.6	2.15
44	Pa.	88.2	86.0	87.6	82.0	4.0	5.50
51	Va.	36.3	36.4	39.8	25.6	8.6	26.20
52	Wash.	72.4	77.2	75.0	73.2	7.3	2.51
54	Wash.	88.2	90.0	86.0	82.6	4.6	2.33
57	Wis.	82.4	84.2	76.2	72.0	6.6	4.35
Av. (Sign.)		79.3	78.5	75.2	65.6	---	---
12	Idaho	87.6	88.0	83.0	81.4	N.S.	0.06
28a	Miss.	80.0	62.2	63.4	59.0	N.S.	1.58
28b	Miss.	90.0	91.2	87.2	85.0	N.S.	1.64
30	Nebr.	86.4	87.2	88.4	82.0	N.S.	1.07
36a	N.Y.	97.6	96.8	97.2	96.4	N.S.	0.56
46	S.C.	83.0	78.2	82.6	83.4	N.S.	1.59
47	S.C.	94.6	94.4	93.8	90.4	N.S.	1.80
48	S.D.	84.8	80.2	75.4	77.8	N.S.	1.73
58	Wyo.	90.4	91.4	88.4	87.2	N.S.	1.99
60	Canada	93.0	94.0	91.0	90.5	N.S.	1.37
Av. (Not sign.)		88.7	86.4	85.0	83.3	---	---
GRAND AV.		82.2	81.0	78.3	71.1	---	---

Table 8. Relative scores for pea seed treatments based upon the number of tests in which they produced a significantly larger stand than any other treatment (Maximum score = 198)

Treatment tested	Spergon at 0.35 %	Spergon at 0.17 %	Spergon at 0.08 %	Arasan at 0.35 %	Arasan at 0.17 %	Arasan at 0.08 %	Fermate at 0.35 %	Fermate at 0.17 %	Fermate at 0.08 %	Untreated check	Score for treatment
	Number of tests treatment in Column 1 was superior to										
Spergon .35%	--	1	3	3	6	6	7	7	16	20	69
Spergon .17%	1	--	1	3	6	6	8	10	15	18	68
Spergon .08%	0	0	--	3	3	4	3	7	11	19	50
Arasan .35%	1	1	3	--	6	6	5	10	12	19	63
Arasan .17%	0	0	0	1	--	1	1	6	9	17	35
Arasan .08%	1	0	0	1	3	--	1	2	8	18	34
Fermate .35%	0	0	1	1	2	3	--	1	6	17	31
Fermate .17%	0	0	0	0	1	1	0	--	4	19	25
Fermate .08%	0	0	0	0	1	1	0	0	--	13	15
None	0	0	0	0	0	0	0	0	0	--	0
Scores against treatment	3	2	8	12	28	28	25	43	81	160	

Table 9. Effect of seed treatment on yield of Thomas Laxton peas

Report from Test no.	Locality	Weight of vines and pods from 100 seed sown: Spergon at rate of .335%	.168%	.084%	Arasan at rate of .335%	.168%	.084%	Fermate at rate of .335%	.168%	.084%	Untreated	Diff. req. sign.	Calc. "F" value
		gms.	gms.	gms.	gms.	gms.	gms.	gms.	gms.	gms.	gms.		
33	L.I.,N.Y.	62310	58561	61969	63502	61628	59356	61742	57027	63502	50325	6864	2.81
40	Ohio (pods)	692	662	618	700	591	509	602	549	585	498	61	10.79
51	Va.	4658	4452	3942	2986	2874	2442	2306	2158	2638	1694	839	11.83
47	S.C.	1447	1364	1414	1439	1567	1468	1502	1820	1463	1503	169	4.56
Average		17277	16260	16986	17157	16665	15944	16538	15388	17047	13505		
01	Calif.	2365	2352	2490	2690	2120	2388	2322	2395	2318	1930	N.S.	1.89
13	Ill.	1971	1982	2031	1947	2057	2059	1787	1868	1883	1974	N.S.	1.04
26	Minn.	3519	3317	3704	3679	3305	3608	3308	3363	3396	3587	N.S.	1.04
28b	Miss.	279	266	303	270	308	277	282	271	295	240	N.S.	0.94
30	Neb.	5206	5458	5410	5691	5051	5416	5138	5341	4946	5220	N.S.	0.52
49	S.D.	[illegible]	2380	2336	2598	2602	2506	2474	2424	2410	2282	N.S.	1.00
52	Wash.	1728	1592	1544	1374	1515	1548	1744	1684	1461	1411	N.S.	0.55
58	Wyo.	3427	3622	3260	3440	3644	3483	3485	3238	3531	3311	N.S.	0.64
Average		2636	2621	2635	2711	2575	2661	2568	2573	2534	2494		

Several investigators took the time and effort to harvest the vines and weigh them, or to pick the pods and weigh them. The data are summarized in Table 9.

The various treatments increased the yields by 15 to 20% as an average of all tests. In the 4 tests where the differences were statistically significant the increase amounted to almost 30% for the better treatments. In one test (#51) the best treatment almost trebled the yield. Although there is no doubt that treatment was effective in increasing yields, no sound conclusion can be reached from the data on the relative value of the different treatments.

Summary. All 3 organic materials can be profitably used as pea seed treatments. Significant improvement in emergence was secured in 69% of the localities, and yields were increased by an average of 15 to 30%. Spergon was more consistently beneficial than the other 2 materials and gave practically as good results when used at 0.17% (1.5 oz./bu.) as at double this rate. The other 2 materials gave better results at 0.35% than at lower dosages. The value of Fermate as a pea seed protectant may be seriously questioned, but Arasan can be used at the heavier rate of application.

NAUGATUCK CHEMICAL DIVISION OF UNITED STATES RUBBER COMPANY, NAUGATUCK, CONN.

IV. LIMA BEAN SEED TREATMENTS

J. C. Walker and W. W. Hare

The Henderson Bush variety of lima bean was used in these tests. The seed was furnished gratis by the Ferry-Morse Seed Company. The following treatments were made in a rotary seed treater: Spergon at 0.2% by weight (0.5 oz. per 15 lb. of seed), and 0.1%; and Fermate at 0.2% and 0.1% by weight. Five replications of 100 seeds each from these treated lots and from an untreated control were planted in randomized blocks by the cooperators under field conditions in all tests except 36b.

The locations, planting dates, soil type, reaction, and moisture at time of planting, precipitation, range of maximum and minimum air temperatures from planting to average date of emergence, and average number of days from planting to emergence are set forth in Table 10.

In Table 11 are given the data from the individual locations, showing the average number of seedlings for each treatment, calculated F value, and the minimum difference in the means required for significance. There were significant differences in 11 of the 26 tests. However, the treatments were significantly better than the check in only 9 tests, since the difference in tests 28b and 35 was between different treatment only.

The data from group analyses of combined tests (method of E. B. Roessler and L. D. Leach) are given in Table 12. When tests 10, 52, and 33 are omitted, the remaining 23 tests (group 2) form a homogeneous group. Tests 10, 52, and 33 (group 1) also form a homogeneous group. In group 1, Spergon at 0.2% and Fermate at 0.2% were significantly better than the check.

In group 2 all treatments are significantly better than the check and Spergon at 0.2%, Spergon at 0.1%, and Fermate at 0.2% are better than Fermate at 0.1%. Spergon at 0.2% and Spergon at 0.1% show no differences, but both are better than Fermate at 0.2%. For practical purposes this analysis indicates the use of Spergon at 0.1% by weight or Fermate at 0.2% by weight, the choice depending on cost and availability.

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Table 10. Location, time, and environmental conditions of lima bean seed treatment tests with the Henderson Bush variety -- 1943

Test no.	State	Planting date	Soil: Type	Soil: pH	Soil: Moisture	Rainfall	Air temperature	Days to emerge
						In.	°F	
10	Ga	3/29	---	5.0	Opt.	0.40	35-86	7
52	Wash.	5/27	Sandy loam	5.7	Opt.	1.05	38-79	--
33	N.Y.	5/28	Loam	5.1	Opt.	2.06	52-92	7
40	Ohio	6/8	Silt loam	6.7	Dry	0.24	52-90	6
34	N.Y.	6/4	Fine sandy loam	6.2	Opt.	1.32	55-92	13
17	Iowa	5/8	Clay loam	6.8-7.2	Opt.	--	--	--
13	Ill.	6/3	Clay loam	6.4	Wet	0.19	53-86	4
36b	N.Y.	5/15	Compost loam	6.99	Opt.	Watered	70-80	--
26	Minn.	5/3	Silt loam	5.7	Dry	2.34	30-87	--
57b	Wis.	5/20	Miami silt loam	6.2	Wet	0.43	46-80	8
8	Fla.	1/29	Fine sandy loam	6.5±	Opt.	0.28	35-83	11
46	S.C.	3/24	Sandy loam	5.5	Opt.	0.57	30-83	12
44	Pa.	6/12	Clay loam	6.8	Opt-dry	0.04	54-93	6
36a	N.Y.	6/11	Silt loam	7.55-7.6	Opt.	1.91	50-96	--
41	Okla.	6/6	Loam	Sl. acid	Opt.	0.32	65-91	5
55	W.Va.	5/18	Clay loam	7.4	Opt.	--	60-88	16
22	Mass.	5/24	Sandy loam	5.9-6.0	Opt.	0.30	43-93	9
28a	Miss.	4/21	Sandy loam	--	Opt.	0	39-92	6
58	Wyo.	5/25	Sandy loam	7.5	Opt.	0.03	31-80	11
1	Calif.	4/30	Fine sandy loam	7.2	Opt.	0	38-89	8
31	N.J.	7/17	Fine sandy loam	5.6	Opt.	0.39	60-92	6
28b	Miss.	4/1	Silt loam	5.4	Dry	0.06	48-88	10
47	S.C.	4/22	Sandy loam	5.8	Opt.	1.61	42-88	6
35	N.Y.	6/3	Sandy loam	5.63	Dry	1.65	55-92	8
51	Va.	5/5	Silt loam	5.9	Opt.	2.49	50-96	12
57a	Wis.	4/21	Miami silt loam	6.2	Wet	1.33	[illegible]-81	19

Table 11. Summary of individual tests with Henderson Bush lima beans, analyzed as randomized block tests

Test no.	State	Average number of seedlings: Spergon 0.2%	Spergon 0.1%	Fermate 0.2%	Fermate 0.1%	Check	F value	MSD
10	Ga.	75.6	55.8	72.6	73.4	74.2	1.5	NS
52	Wash.	71.6	68.0	60.8	52.6	40.4	9.94	13.4
33	N.Y.	77.6	76.0	74.4	68.2	72.4	1.05	NS
40	Ohio	72.6	63.6	68.2	68.2	65.6	0.49	NS
34	N.Y.	58.6	52.0	56.4	64.0	52.0	2.14	NS
17	Iowa	32.0	30.6	41.2	30.0	26.8	3.10	9.2
13	Ill.	75.2	73.2	70.8	64.6	64.4	2.65	NS
36b	N.Y.	47.0	31.0	18.8	15.0	9.4	24.91	9.0
26	Minn.	29.2	33.6	39.8	37.0	31.6	2.03	NS
57b	Wis.	41.2	38.8	47.8	44.2	34.6	3.18	8.5
8	Fla.	66.6	66.6	58.8	62.8	58.8	2.16	NS
46	S.C.	76.4	73.8	73.2	75.8	68.6	1.44	NS
44	Pa.	78.8	81.6	77.2	79.2	78.8	0.38	NS
36a	N.Y.	76.6	73.6	71.2	71.2	74.6	0.89	NS
41	Okla.	73.4	75.8	76.8	78.4	72.8	1.13	NS
55	W.Va	60.8	60.6	59.8	54.2	45.6	8.96	6.5
22	Mass.	80.0	77.8	74.8	73.2	70.4	3.11	6.4
28a	Miss.	67.6	62.2	61.6	61.4	48.0	11.73	6.3
58	Wyo.	41.6	40.0	42.0	44.0	29.8	6.95	6.4
1	Calif.	63.4	64.0	61.6	61.0	60.0	0.62	NS
31	N.J.	83.4	83.4	80.0	78.8	84.1	1.45	NS
28b	Miss.	77.0	76.4	76.4	68.2	73.8	3.24	6.1
47	S.C.	70.2	69.2	76.6	72.6	62.2	6.81	6.1
35	N.Y.	82.0	80.4	76.2	73.2	81.0	3.53	5.7
51	Va.	72.4	75.2	69.0	70.2	69.0	1.91	NS
57a	Wis.	5	3.2	4.2	6.8	2.4	1.06	NS

Table 12. Summary of group analyses of tests with Henderson Bush lima beans -- 1943

Group	No. of locations	Average number of seedlings: Spergon 0.2%	Spergon 0.1%	Fermate 0.2%	Fermate 0.1%	Check	Average error var.	F value	MSD
1	3[a]	74.9	66.6	69.3	64.7	62.3	91.33	3.85	7.0
2	23[b]	62.2	61.8	60.1	56.7	55.0	31.52	36.89	1.5

a -- Test nos. 10, 52, 33

b -- Test nos. 40, 34, 17, 13, 36b, 26, 57b, 8, 46, 44, 36a, 41, 55, 22, 28a, 58, 1, 31, 28b, 47, 35, 51, 57a

V. SOYBEAN SEED TREATMENTS

R. H. Porter

Cooperative tests of chemical protectants for soybeans were initiated during 1943. Seed of the field variety Mukden was treated and distributed to 15 cooperators in 13 States, while treated seed of the edible variety Kanro was tested by 4 cooperators. These cooperators planted 5 replications of 100 seeds each in 8 feet of row. Records on environmental conditions under which the tests were made are summarized in Table 13.

The protectants used were Spergon, 1 1/2 oz./bu. (.156 percent) and Arasan, Semesan Jr., and Fermate, each 1 oz./bu. (.104 percent). Data on emergence records of the various treated lots are summarized in Tables 14, 15, 16 and 17. Data from Georgia are omitted from these summaries because the soil was very dry at planting time, emergence was extremely variable, and the error for treatments was exceptionally high (423.34).

It may be noted in Table 14 that there were only 3 tests of the variety Mukden in which the differences between treatments are significant. Treatments gave a significant increase in germination in 2 cases at Minnesota and 3 at Virginia, while at Iowa 1 treatment gave a significant decrease in germination. In 3 other plots the differences between treated and untreated as a whole are significant but not between treatments. In the remaining 7 tests the differences between treated and untreated seed and between treatments were not significant.

A regrouping of the data by plots is shown in Tables 15 and 16 on the basis of small and intermediate errors. The data for Tennessee and Oklahoma showed rather large errors and are omitted.

The "F". value for the data in Table 15 is 7.9 and since the value for significance at the 5% point is 2.46 the data indicate a significant difference between treatments. The value for least significant difference is 2.38 which means that the mean percentages of germination at these 6 stations for 3 treatments are significantly greater than the untreated.

Analysis of the data in Table 16 show no significant differences between the means of treatments at the 5 locations.

The data for the variety Kanro are given in Table 17.

Table 13. Air temperature, soil reaction, and rainfall data from soybean seed treatment plots 1943.

Cooperating Station	Date range	Average air temperature Max.	Average air temperature Min.	Soil moisture at planting time	Soil pH	Total Rainfall (inches)	Days for Seedlings to emerge
Michigan	6/19			Optimum	6.8-7.2		3
Minn.[c]	5/15 6/13	69.1	51.8	Wet		9.57	
N.Y.(Cornell)	7/17 to 7/30	85.4	69.7	Wet	6.2	1.23+	4
N.Y.(Geneva)	6/16 to 6/29	89.8	64.6	Dry	7.6-7.8	1.74+	6-8
Okla.	4/22 to 5/10	81.3	58.0	Dry	Neutral to basic	5.21[a]	6
Penn.	7/31 to 8/20			Dry	6.9	2.01+	8
R. I.	5/14 to 6/10	65.8	46.6	Wet	6.2	1.33	11
S. Car (Charleston)	4/13 to 4/23	71.0	46.5	Optimum	5.5	1.64	10
Tenn.	5/3 to 5/11	82.5	59.5	Optimum	5.6	.96	8
Virginia	5/26 to 6/ 2	78.3	52.9	Optimum	5.21	3.75	--
West Va.	5/29 to 6/ 7	75.8	68.8	Optimum	7.4	b	10
Ga.	5/8 to 6/ 2	87.0	60.4	Dry	5.6	2.08	12
Wis.	5/27 to 6/10	73.6	58.6	Optimum	---	1.74	12
Iowa	5/20 to 6/3	76.5	55.0	Optimum	6.4-6.8	1.78	8
S. Car. (Edisto)	5/14 to 5/19	85.7	65.5	Dry	5.7	0.50	5

[a] All came 5/7 to 5/10 [b] Heavy rains May 30 and 31
[c] Average maximum soil temperature 67.7°F. and minimum 55.3°F.

Table 14. Percentage emergence of Mukden soybeans from treated and untreated seed. 1943.

Report from Coop. Station	Error	Average percentage field germination Check	Arasan	Spergon.	Sem.Jr.	Fermate	Least Dif. for sig.
Mich.	42.29	72.0	71.2	72.4	70.0	74.6	
Minn.	26.67	60.4	70.8	69.8	66.4	66.4[a]	6.91
N.Y.(Cornell)	47.4	74.2	68.8	73.8	73.6	70.6	
N.Y.(Geneva)	38.21	76.8	81.8	75.4	78.4	78.8	
Okla.	76.5	70.2	66.6	76.6	67.2	68.6	
Pa.	19.37	78.6	79.4	81.8	78.4	75.2	
R. I.	13.1	74.6	77.4	81.2	78.8	75.0[b]	—
S. Car.	12.26	82.6	87.0	86.4	88.2	82.6[b]	
Tenn.	89.78	46.4	59.4	61.6	53.4	52.2[b]	
Va.	26.23	48.8	53.4	58.6	47.0	55.6[a]	2.8
W. Va.	41.13	76.2	76.4	80.0	78.6	80.4	
Wis.	30.64	81.6	81.4	78.2	78.2	81.8	—
Iowa	14.29	80.2	80.2	80.2	83.6	75.4[a]	3.68

[a] Differences between treatments significant and also between check and some of the treatments.
[b] Differences between check and treatment or treatments significant.

Table 15. Summary of field germination data from 6 plots planted with treated and untreated Mukden soybean seed 1943.
(Small error)

Report from	Error	Percentage of emergence				
		Check	Arasan	Spergon	Semesan Jr.	Fermate
Minn.	26.67	60.4	70.8	69.8	66.4	66.4
Penn.	19.37	78.6	79.4	81.8	78.4	75.2
R. I.	13.1	74.6	77.4	81.2	78.8	75.0
So.Car.	12.26	82.6	87.0	86.4	88.2	82.6
Va.	26.23	48.8	53.4	58.6	47.0	55.6
Iowa	14.29	80.2	80.2	80.2	83.6	75.4
Mean		70.9	74.7	76.3	73.7	71.7

Table 16. Summary of field germination data from 6 plots planted with treated and untreated Mukden soybean seed. 1943
(Intermediate Error)

Report from	Error	Percentage of Emergence				
		Check	Arasan	Spergon	Semesan Jr.	Fermate
Mich.	42.29	72.0	71.2	72.4	70.0	74.6
N.Y. (Cornell)	47.4	74.2	68.8	73.8	73.6	70.6
N. Y. (Geneva)	38.21	76.8	81.8	75.4	78.4	78.8
W. Va.	41.13	76.2	76.4	80.0	78.6	80.4
Wis.	30.64	81.6	81.4	78.2	78.2	81.8
Mean		76.2	75.9	76.0	75.8	77.2

Table 17. Summary of field germination data from 4 plots planted with treated and untreated Kanro soybean seed 1943.

Report from	Error	Percentage of emergence				
		Check	Arasan	Spergon	Semesan Jr.	Fermate
Iowa	12.41	80.4	89.0	85.2	85.4	88.6
N.Y. (Geneva)	17.88	83.4	87.8	89.2	83.4	86.8
Okla.	27.08	76.8	89.0	85.8	77.2	84.6
S. Car.	8.36	89.2	93.8	91.8	93.4	94.2
Mean		82.4	89.9	88.0	84.8	88.6

Table 18. Yield of soybeans from plots planted with treated and untreated seed. Ames, Iowa, 1943.

Variety	Mean number grams per 8 foot row				
	Check	Arasan	Spergon	Semesan Jr.	Fermate
Mukden	475.3	490.3	477.9	483.6	484.2
Kanro	356.5	399.9	364.7	361.4	368.8

Analysis of variance of the data from each station in Table 17 as well as from the stations as a whole gives the following results:

1. Differences between treatments are significant at Iowa and Oklahoma with the least difference for significance being 4.72 for the former and 7.01 for the latter.
2. The difference between untreated and treated is significant at South Carolina but not at New York.
3. Analyzing the data as a whole the "F" value is 11.2 with an "F" value of 2.51 required for significant difference at the 5% point between treatments. The figure for least significant difference between the means of the counts at the 4 stations is 2.28 which indicates that for the results as a whole each treatment increased the germination significantly above the untreated. Three treatments were about equal and one was less effective than the others.

One other test was made at Edisto, South Carolina with the variety Volstate. The percentages of germination were Check 14.6, Arasan 34.0, Spergon 64.4, Semesan Jr. 47.0, and Fermate 57.8. The benefit from treatment was very pronounced.

Yield data from the 2 varieties Mukden and Kanro were obtained at the Iowa station. The results are given in Table 18. Analysis of the data showed no significant differences in the yields from rows planted with treated and untreated seed.

It is believed that the data from these several tests made in 1943 indicate that further studies are necessary. The tests in 1944 will be made only with a vegetable variety and different dosages will be used.

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VI. SPINACH SEED TREATMENTS

Richard P. Porter

During the 1943 growing season, the following chemical seed treatments were tested on spinach: Arasan at dosages of 0.25, 0.50, 0.75, and 1.00%; Fermate at 0.25, 0.50, 0.75, and 1.00%; and zinc oxide at 2.00%. Forty-seven sets of data from 39 cooperators located in 30 States of the United States and 2 Provinces of Canada were submitted for summation and final analysis.

The data in Table 19 show the geographical location, the cooperator, and the environmental conditions under which each test was conducted.

Table 20 is a summary of all the spinach tests conducted in 1943, ranked according to the magnitude of their error variances. This grouping of tests facilitates the application of the Chi-square test of the homogeneity of the data from the different locations. Twenty-four tests with low error variances are given together in one homogeneous group (Group I), and 20 tests with higher error variances form Group II. Although 2 of the 3 remaining tests form a third homogeneous group (Group III), representative of the performance of the treatments in a limited area, they probably should not be considered as typical.

Emergence. The least difference required for significance between the means of Group I is 1.5 seedlings (Table 21). All treatments significantly increased emergence, Arasan at 1.00% being the best treatment with a mean germination of 69.9 seedlings. The only treatments significantly lower in germination than Arasan 1.00%, are Arasan 0.25% and Fermate 0.25%, 0.50%, and 0.75%. Fermate 0.25% is the only treatment significantly less than zinc oxide 2.00%.

The least difference required for significance between means of Group II is 2.6 seedlings (Table 21). All treatments significantly increased emergence, and Arasan at 1.00% is again the best. Arasan at 0.25% and Fermate at 0.25% and 0.50% are the least favorable of the treatments and show a mean germination significantly less than the best treatment, and are significantly less than zinc oxide 2.00%.

Group III, made up of only 2 tests, is homogeneous, but too few tests are included to make valid estimates of the value of the different treatments.

Damping-off. In 10 of the 47 tests conducted this year enough post-emergence damping-off occurred for the cooperators to make counts. Table 22 shows the total number of seedlings emerged, the total number damped-off, and the percentage of post-emergence damping-off for each treatment. The results for these 10 tests indicate that seed treatment tends to reduce post-emergence damping-off. Arasan is evidently the most effective fungicide in this respect, since seed treated with 1.00% showed an average of 7.2% post-emergence damping-off while the untreated seed showed 17.2%. The zinc oxide 2.00% treatment was approximately as affective as

Table 19. Location, time, and environmental conditions of spinach seed treatment tests -- 1943

Report from		Planting date	Planted in[a]	Soil condition		Rainfall	Av. temperature	Days to emerge	Soil type
Test no.	Locality			pH	Moisture	In.	Min.-Max. °F.		
1	Calif.	2/17	--	7.1	---	1.51	42.8-64.0	18	Fine sandy loam
2	Conn.	2/25	GB[a]	5.25	Wet	--	59.3-84.5	15	Fine sandy loam
3	Conn.	5/17	Field	6.2	Opt.	3.90	48.3-70.6	18	Sandy loam
5	Del.	4/24	Field	--	Opt.	.01	42.7-70.0	11	Sandy loam
6	Fla.	2/20	Field	6.5	Opt.	0.89	48.3-69.9	8	Loamy fine sand
7	Fla.	3/2	Field	5.8	Opt.	3.77	46.6-68.1	6	Loamy sand
9	Fla.	3/10	Field	7.2	Dry	0.61	57.6-79.1	5	Sandy loam
10	Ga.	2/13	Field	5.4	Opt.	0.50	31.4-61.1	10	Tifton series
12	Idaho	5/25	Field	--	Opt.	0.35	42.8-61.7	12	Silt loam
11	Ga.	4/15	GF[a]	5.5	Opt.	3.26	43.9-69.3	12	Sandy loam
13	Ill.	5/18	GF	7.5	Opt.	--	-- --	5	Sandy loam
17	Iowa	4/8	--	6.8	Opt.	--	-- --	---	Clay loam
20	Md.	4/8	Field	5.6	Dry	2.92	35.4-61.3	19	Sandy loam
22	Mass.	4/29	Field	5.9	Opt.	1.88	39.0-65.7	12	Gr. sandy loam
24	Mich.	5/4	Field	6.8-7.2	V.wet	--	-- ---	23	Sandy loam
26	Minn.	4/23	Field	5.7	Opt.	0.59	38.4-60.5	21	Silt loam
28a	Miss.	2/26	Field	5.4	Opt.	3.82	37.5-57.5	17	Silt loam
28b	Miss.	2/25	Field	4.5	Opt.	3.11	37.2-57.1	10	Sandy loam
28c	Miss.	2/25	Field	6.7	Opt.	3.99	32.8-55.9	19	Fine sandy loam
28d	Miss.	2/24	Field	5.7	Opt.	1.54	31.2-53.7	14	Ochlochnee loam
31	N.J.	9/25	Field	5.8	Dry	0.21	48.9-73.0	8	Sassafras loam
33	N.Y.	3/27	Field	5.1	Opt.	1.65	32.4-48.9	23	Sassafras loam
34	N.Y.	7/2	Field	6.2	Opt.	2.64	64.1-78.0	7	Fine sandy loam
35	N.Y.	6/26	GB	6.6	Opt.	2.16	65.4-80.7	12	Sandy loam
36a	N.Y.	5/14	GF	6.99	Opt.	--	--- ---	10	Silt loam compost
36b	N.Y.	5/18	Field	7.77	Wet	4.70	54.3-75.3	23	Silt loam
39	N.D.	4/15	Field	7.00	Opt.	0.73	33.3-60.2	12	Fargo clay
40a	Ohio	4/29	Field	5.5	Opt.	1.42	45.7-68.1	17	Muck
40b	Ohio	5/4	Field	6.5	Opt.	2.67	48.0-67.0	15	Silt loam
41	Okla.	4/8	Field	6.8	Opt.	1.08	50.6-75.4	8	Loam
43.1	Oreg.[b]	5/8	Field	5.9-6.1	Opt.	0.20	43.3-68.0	18	Clay loam
44	Pa.	4/28	Field	6.8	Opt.	0.34	44.0-66.6	9	Clay loam
45	R.I.	5/7	Field	6.2	Wet	2.82	46.7-65.5	12	V.f.sandy loam
46	S.C.	3/19	Field	6.1	Opt.	2.57	42.9-69.2	8	Sandy loam
47	S.C.	3/11	Field	5.8	Opt.	0.63	53.7-74.1	7	Sandy loam
48	S.D.	4/24	Field	6.5	Dry	0.94	37.1-64.1	28	Sandy loam
49	Tenn.	3/10	Field	7.0	Opt.	2.88	44.2-67.1	10	Sandy loam
50	Texas	3/1	Field	7.0	Opt.	0.00	50.4-75.8	10	Fine sandy loam
51a	Va.	2/3	GB	5.75	Opt.	--	67.5-82.8	6	Silt loam
51b	Va.	9/15	Field	6.05	Wet	1.22	81.0-88.1	9	Silt loam
51c	Va.	3/12	Field	6.2	Opt.	0.96	46.4-70.1	9	Silt loam
52	Wash.	5/19	Field	5.7	Dry	0.83	43.5-68.0	18	Sandy loam
55	W.Va.	5/20	GF	5.4	V.wet	--	-- --	12	Loam
57	Wis.	4/21	Field	6.5	Opt.	1.01	45.1-65.9	15	Miami silt loam
58	Wyo.	4/29	Field	7.5	Opt.	0.45	37.1-52.1	21	Sandy loam
59	Canada	6/3	GF	--	Opt.	--	54.0-91.3	6	Greenhouse comp.
60	Canada	6/1	GB	7.5	Opt.	--	52.1-80.4	9	Sandy loam

a -- GB = greenhouse bench; GF = greenhouse flats

b -- Oregon, test made by P. W. Miller and F. P. McWhorter

Table 20. Summary of spinach seed treatment tests analyzed separately as randomized block experiments.

Report from: Test no.	Locality	Average number of seedlings emerged: Arasan 0.25 %	Arasan 0.50 %	Arasan 0.75 %	Arasan 1.00 %	Fermate 0.25 %	Fermate 0.50 %	Fermate 0.75 %	Fermate 1.00 %	Zinc oxide 2.00 %	Untreated	Error variance (V_i)	Log V_i
49	Tenn.*	79.8	78.6	76.6	79.6	78.4	85.4	75.0	75.6	80.2	63.6	3.0	0.4771
51c	Va.	84.2	81.4	81.0	86.2	79.8	82.2	81.8	81.2	82.8	80.2	12.0	1.0792
59	Canada*	82.2	83.2	82.2	83.4	85.0	84.4	85.0	85.6	81.2	72.2	15.5	1.1903
33	N.Y.*	81.2	78.6	76.0	83.8	78.0	81.0	80.6	81.4	80.8	57.8	20.4	1.3096
51a	Va.	53.8	57.4	56.0	58.6	59.2	53.4	58.2	56.4	57.2	49.0	22.4	1.3502
60	Canada*	88.2	87.8	87.0	91.0	90.6	87.2	86.4	86.0	88.4	72.4	22.7	1.3560
51b	Va.	69.6	69.2	71.8	74.8	58.6	67.2	67.0	72.8	69.8	41.0	24.2	1.3838
47	S.C.*	74.8	78.6	81.0	67.8	72.4	69.2	78.0	79.6	72.2	64.4	25.6	1.4082
40b	Ohio*	63.4	63.4	63.2	68.6	49.0	63.2	59.4	60.2	61.8	27.2	27.6	1.4409
39	N.D.	75.4	75.6	68.8	72.0	74.4	72.0	78.2	72.4	73.8	72.0	28.9	1.4609
11	Ga.*	63.4	64.0	69.0	67.0	62.4	72.8	63.2	70.4	53.8	67.2	33.2	1.5211
58	Wyo.*	69.6	60.4	57.8	60.2	61.4	66.6	66.0	58.4	61.6	66.4	33.9	1.5302
22	Mass.*	80.4	76.2	81.6	80.2	83.4	75.8	81.6	81.4	81.2	62.6	34.4	1.5366
28a	Miss.*	64.8	64.4	67.8	73.4	67.0	61.6	66.8	67.2	67.0	41.4	35.8	1.5539
57	Wis.*	76.0	71.6	74.6	66.8	75.2	71.8	73.2	72.2	74.0	54.4	41.0	1.6128
44	Pa.*	79.0	74.2	75.0	79.2	66.6	73.2	76.4	80.8	78.0	48.6	42.5	1.6284
3	Conn.*	53.4	63.0	54.4	65.8	54.6	56.6	57.2	57.4	58.8	44.2	43.3	1.6365
10	Ga.*	45.8	47.0	45.4	43.6	47.4	51.6	55.0	54.0	57.4	43.8	44.6	1.6493
36b	N.Y.	13.0	18.8	13.6	13.8	16.2	12.2	17.2	17.0	21.8	13.2	45.3	1.6561
36a	N.Y.*	74.6	78.8	79.6	76.8	55.6	72.4	71.4	72.6	63.6	41.6	45.8	1.6609
21	Calif.*	64.4	70.6	75.6	73.8	67.8	65.0	70.4	67.0	72.4	60.2	49.0	1.6902
40a	Ohio*	61.0	72.0	69.8	67.2	68.2	66.0	60.4	72.8	75.8	53.2	52.2	1.7177
17	Iowa*	56.8	64.4	68.0	63.2	68.2	68.0	64.6	56.2	56.6	54.8	55.5	1.7443
31	N.J.*	69.6	73.8	68.0	80.0	50.8	67.6	67.8	73.4	77.8	65.6	59.3	1.7730
Average		67.7	68.9	68.7	69.9	65.4	67.3	68.4	68.8	68.7	54.9		
9	Fla.*	68.6	70.0	70.6	69.4	63.2	72.8	67.6	69.6	71.8	39.8	63.5	1.8028
41	Okla.*	45.0	50.2	50.2	48.8	47.8	49.8	49.0	56.4	56.8	14.8	63.5	1.8028
5	Del.*	53.0	59.6	56.4	64.4	52.4	56.2	65.2	52.0	58.8	38.8	66.4	1.8222
46	S.C.*	67.8	69.6	63.0	70.4	62.4	63.8	67.6	68.8	60.2	30.4	66.6	1.8235
24	Mich.*	52.2	50.2	51.8	51.8	46.8	45.2	50.8	55.2	51.4	16.0	68.0	1.8325
28b	Miss.*	50.0	65.8	59.0	64.2	53.4	53.8	61.8	63.0	59.4	42.0	69.6	1.8426
28d	Miss.	65.6	62.0	66.0	65.2	65.6	65.0	69.8	67.0	70.4	60.2	72.8	1.8621
26	Minn.	53.8	52.0	60.8	59.6	53.0	55.6	58.6	52.2	52.8	46.4	73.3	1.8651
55	W.Va.*	61.8	68.6	65.8	74.2	62.4	76.2	70.6	75.0	65.4	44.8	77.7	1.8904
34	N.Y.*	39.6	40.4	43.4	51.8	40.0	29.2	45.2	46.6	41.4	26.8	79.2	1.8987
45	R.I.*	44.4	47.6	54.2	47.6	33.2	54.0	52.0	43.6	57.4	21.8	86.3	1.9360
7	Fla.*	65.4	62.0	58.4	61.4	58.2	60.0	69.2	67.6	60.6	45.4	86.7	1.9380
35	N.Y.	62.2	58.8	64.6	62.0	60.8	60.8	75.4	65.0	74.6	60.6	88.0	1.9445
6	Fla.	71.8	66.4	73.2	79.8	70.8	70.2	77.0	72.6	75.8	68.2	89.6	1.9523
50	Texas*	66.0	75.6	74.0	73.6	60.0	68.0	72.2	73.4	69.2	35.2	92.3	1.9652
43.1	Oreg.	32.6	34.8	38.6	36.4	37.6	45.8	33.0	40.6	48.0	36.6	93.2	1.9694
48	S.D.	50.0	61.4	57.4	60.0	46.2	52.2	55.6	55.4	53.0	55.4	94.4	1.9750
20	Md.	27.6	19.0	13.4	16.6	21.4	20.4	20.6	13.2	13.8	13.6	110.2	2.0422
13	Ill.*	47.4	66.0	53.8	65.2	39.2	45.4	51.4	51.4	50.0	22.4	163.4	2.2132
2	Conn.*	53.4	59.8	57.2	51.2	21.2	50.4	58.6	56.0	55.2	21.8	169.1	2.2281
Average		53.9	57.0	56.6	58.7	49.8	54.7	58.6	57.5	57.3	37.0		
12	Idaho*	45.0	44.4	45.0	48.8	40.8	41.6	47.2	41.6	65.6	26.0	180.5	2.2565
52	Wash.	68.4	69.6	64.0	68.8	64.8	65.6	63.6	70.0	68.0	41.4	185.5	2.2683
Average		56.7	57.0	54.5	58.8	52.8	53.6	55.4	55.8	66.8	33.7		
28c	Miss.	22.4	36.4	32.0	20.2	18.8	29.6	43.2	19.4	37.8	23.0	399.9	2.6019

*Significant differences betwen treatments were indicated by the analyses at these locations *

Table 21. Effect of chemical seed treatments on emergence of spinach seedlings

Reports on Group	No. locations	Arasan 0.25 %	Arasan 0.50 %	Arasan 0.75 %	Arasan 1.00 %	Fermate 0.25 %	Fermate 0.50 %	Fermate 0.75 %	Fermate 1.00 %	Zinc oxide 2.00 %	Untreated	Av. error variance	Least diff. req. sign.
1	24	67.7	68.9	68.7	69.9	65.4	67.3	68.4	68.8	68.7	54.9	34.09	1.5
2	20	53.9	57.0	56.6	58.7	49.8	54.7	58.6	57.5	57.3	37.0	88.69	2.6
3	2	56.7	57.0	54.5	58.8	52.8	53.6	55.4	55.8	66.8	33.7	183.00	12.1

Table 22. Effect of chemical seed treatments on post-emergence damping-off of spinach seedlings.

Records on	Arasan 0.25%	Arasan 0.50%	Arasan 0.75%	Arasan 1.00%	Fermate 0.25%	Fermate 0.50%	Fermate 0.75%	Fermate 1.00 %	Zinc oxide 2.00 %	Untreated
Emergence	3208	3493	3376	3493	2860	3326	3327	3454	3350	2032
Damped off	370	345	259	252	450	382	321	295	366	349
Percent damped off	11.5	9.9	7.7	7.2	15.7	11.5	9.6	8.5	10.9	17.2

Table 23. Cost of treating 100 pounds of spinach seed with Arasan, Fermate, or Zinc Oxide at different dosages.

Treatment	Cost for treatment at dosage 0.25%	0.50%	0.75%	1.00%	2.00%
	$	$	$	$	$
Arasan[a]	0.29-0.40	0.57-0.80	0.86-1.20	1.15-1.60	
Fermate[b]	0.15	0.30	0.45	0.60	
Zinc oxide[c]					0.45-0.60

[a] Quoted July 19, 1943, sold in 8 oz. to 100 lb. containers.
[b] Quoted September 25, 1943, sold in 25 lb. fiber drums.
[c] Quoted July 1943, cost includes price of graphite.

Arasan at 0.25% and Fermate at 0.50% (Table 22).

Cost of Treatment. The cost of treating 100 pounds of spinach seed with Arasan, Fermate, or zinc oxide at different dosages is given in Table 23. Although Arasan is the most expensive fungicide, and Fermate is more costly than zinc oxide, the cost of treatment at minimum effective dosages is approximately the same for all 3 materials. It should be pointed out, however, that graphite, a disagreeable material to handle, probably should be added to Fermate at all dosages tested, and to Arasan at the higher dosages when seed is to be drilled. This will increase the cost of treatment slightly.

Summary and Conclusions.

1. Results from 47 tests conducted during 1943 at various locations in the United States and Canada indicated that chemical treatments of spinach seed with Arasan and Fermate at dosages 0.25, 0.50, 0.75, and 1.00%, and zinc oxide at a dosage of 2.00% significantly increased emergence.

2. Arasan (0.50, 0.75, and 1.00%) and Fermate (0.75 and 1.00%) treatments proved to be equal or superior to the standard zinc oxide (2.00%).

3. Data from 10 tests showed that chemical treatment of spinach seed apparently had some effect in reducing post-emergence damping-off. The most effective treatment (Arasan at 1.00%) reduced it by 10%.

4. The cost of treatment with the various materials at minimum effective dosages is approximately equal.

5. Chemical dust seed treatments recommended to control seed decay and reduce damping-off of spinach are Arasan 0.50%, or Fermate 0.75%, or zinc oxide 2.00%. Graphite probably should be added to the Fermate or zinc oxide-treated seed if it is to be sown by planter.

VIRGINIA TRUCK EXPERIMENT STATION, NORFOLK

VII. BEET SEED TREATMENTS

L. D. Leach

Garden beet seed of the variety Detroit Dark Red was treated with 3 fungicides, Yellow Cuprocide, Arasan, and Ceresan, at 3 different dosages and planted along with non-treated seed in randomized plots consisting of 5 replications. Yellow Cuprocide was used at 1.0, 2.0 and 3.0% of the seed weight; Arasan at 0.25, 0.5 and 1.0%; and Ceresan at 0.5, 1.0 and 1.5%.

Nineteen complete tests were conducted by cooperators at 16 experiment stations and the results are presented in Tables 24 and 25. Only 3 of the 19 tests showed significant differences. Two tests (No. 13 and 40b) indicated that the intermediate or higher dosages of each material significantly increased the stand as compared to the non-treated while the third test (No. 22) showed only indications of stand reduction from certain treatments. Considered individually these tests yield little information on the relative efficacy of different dosages of the 3 fungicides.

An analysis of the combined results of the 19 tests show that their variances do not represent a homogeneous group[1]. To produce a homogeneous group it is necessary to eliminate 9 of the tests, 4 with high and 5 with low variances. The averages for the remaining 10 tests are as follows:

Emergence from seed treated with

Yellow Cuprocide			Arasan			Ceresan			Non-
1.0%	2.0%	3.0%	0.25%	0.50%	1.0%	0.5%	1.0%	1.5%	treated
98.7	95.8	96.9	98.9	101.3	103.9	99.2	100.2	101.4	90.0

An analysis of the variance ratio leads to a significant F value and the significant difference between the means of treatments at the 5% points is found to be 5.8 seedlings. It therefore appears that all treatments significantly improved the emergence as compared with the non-treated. Arasan at 1% dosage is significantly better than Yellow Cuprocide at 2.0 or 3.0% but there are no other significant differences between treatments.

With the elimination of only 2 tests it is possible to divide the remaining 17 into 2 homogeneous groups with 9 and 8 tests respectively. The averages for these 2 groups are as follows (page 32, bottom):

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[1] Roessler, E. B. and L. D. Leach
Analysis of combined seed treatment tests. (Mimeographed)

Table 24. Location, time, and environmental conditions under which tests were conducted.

Report from Test No.	Locality	Planting date	Soil conditions: Soil type	Soil conditions: Reaction	Soil conditions: Moisture	Precipitation	Temperature of air: Max.	Temperature of air: Min.	Days to emerge
				pH		in.	°F.	°F.	
01	Calif.	2/18	Sandy loam	7.2	Opt.	.86	64	42	11
02	Conn.	2/10	F.Sandy loam	5.2	Wet	W	91	56	4-6
10	Ga.	3/15	---	5.4	Opt.	1.13	74	47	10
13	Ill.	5/18	Sandy loam	6.9	Opt.	---	--	--	5
17	Iowa	4/8	Clay loam	7.0	Opt.	---	--	--	--
22	Mass.	4/30	Sandy loam	6.0	Opt.	2.39	65	41	10
24	Mich.	5/4	Sandy loam	7.0	Wet	---	--	--	--
28a	Miss.	2/25	F. Sandy loam	6.7	Opt.	3.28	60	37	18-27
28b	Miss.	3/18	---	6.6	Opt.	.20	66	40	9
28c	Miss.	2/26	Silt loam	5.4	Opt.	3.82	56	37	12
34	N. Y.	6/28	F. Sandy loam	6.5	V.dry	4.01	78	64	--
36	N. Y.	6/22	Silt loam	7.8	V.dry	1.93	85	61	--
40a	Ohio	4/26	Silt loam	6.5	Opt.	1.92	62	38	--
40b	Ohio	4/29	Muck	5.5	Opt.	1.42	70	46	--
43.1	Ore.[a]	3/10	Clay loam	6.0	Opt.	.51	56	37	18
44	Pa.	4/29	Clay loam	6.8	Opt.	2.00	68	47	--
48	S. D.	4/28	Sandy loam	---	Dry	1.59	66	39	--
52	Wash.	5/19	Sandy loam	5.7	Dry	.83	68	43	--
54	Wash.	5/7	Loam	7.2	Wet	.72	57	38	--

[a] Conducted by P. W. Miller and F. P. McWhorter

Group I — Emergence from seed treated with

Yellow Cuprocide 1.0%	Yellow Cuprocide 2.0%	Yellow Cuprocide 3.0%	Arasan 0.25%	Arasan 0.50%	Arasan 1.0%	Ceresan 0.5%	Ceresan 1.0%	Ceresan 1.5%	Non-treated
99.7	92.9	94.7	99.3	100.0	102.2	98.4	99.0	99.4	94.0

Group II — Emergence from seed treated with

Yellow Cuprocide 1.0%	Yellow Cuprocide 2.0%	Yellow Cuprocide 3.0%	Arasan 0.25%	Arasan 0.50%	Arasan 1.0%	Ceresan 0.5%	Ceresan 1.0%	Ceresan 1.5%	Non treated
98.8	107.2	104.2	104.9	109.6	107.8	105.6	110.0	111.4	97.7

Table 25. Effect of seed treatments on emergence of garden beets.

Report from: Test no.	State	Yellow Cuprocide 1.0%	Yellow Cuprocide 2.0%	Yellow Cuprocide 3.0%	Arasan 0.25%	Arasan 0.50%	Arasan 1.0%	Ceresan 0.5%	Ceresan 1.0%	Ceresan 1.5%	Non-treated	Sign. diff.[a]	Calc.- "F" value
13	Ill.	85.6	129.2	112.4	91.2	129.2	101.4	120.6	150.8	124.8	59.2	36.3	4.39
22	Mass.	133.0	171.8	143.4	146.2	154.0	137.4	162.6	157.0	157.8	157.4	11.4	8.65
40b	Ohio	107.4	137.0	139.6	123.6	133.7	136.2	106.8	131.8	147.0	103.2	15.88	4.76
Av.	(Sign.)	108.7	146.0	131.8	120.3	139.0	125.0	130.0	146.5	143.2	106.6	---	--
01	Calif.	128.9	116.6	109.4	120.8	122.2	123.4	117.2	112.2	121.2	102.8	NS	0.80
02	Conn.	83.8	80.6	86.4	89.4	92.8	90.6	82.8	92.4	90.4	81.2	NS	1.27
10	Ga.	61.8	78.6	70.8	69.4	77.8	79.2	68.4	60.2	66.0	64.4	NS	0.89
17	Iowa	89.6	73.0	84.0	85.0	79.4	79.6	81.8	84.8	86.0	75.8	NS	0.93
24	Mich.	75.8	79.6	84.2	85.6	93.2	89.0	84.8	88.0	89.0	66.0	NS	1.72
28a	Miss.	43.2	57.0	45.6	66.8	65.8	64.2	38.4	26.4	61.0	44.4	NS	0.90
28b	Miss.	79.6	64.2	64.4	69.2	69.4	67.6	66.4	64.8	75.8	66.8	NS	0.59
28c	Miss.	147.6	142.2	133.8	135.0	142.0	155.2	144.0	142.8	141.6	122.6	NS	1.30
34	N.Y.	88.2	80.4	81.4	91.4	92.8	95.0	87.4	112.4	92.0	100.2	NS	1.96
36	N.Y.	44.8	48.4	43.2	52.4	48.2	55.6	55.2	49.6	42.8	39.6	NS	1.27
40a	Ohio	109.6	125.6	115.0	115.0	122.2	123.4	121.0	125.8	123.8	108.4	NS	2.12
43.1	Oreg.	146.0	141.6	137.8	142.2	153.2	150.2	149.6	150.6	154.8	150.2	NS	1.32
44	Pa.	126.8	122.8	133.8	127.2	126.8	128.0	128.2	128.8	119.0	115.8	NS	0.53
48	S.D.	81.0	63.2	67.6	81.4	75.4	85.6	82.0	76.6	76.6	82.8	NS	1.08
52	Wash.	110.0	91.4	107.6	109.8	110.8	105.4	110.2	100.6	105.4	94.4	NS	0.69
54	Wash.	73.2	76.4	83.6	89.6	82.8	80.8	81.4	92.2	97.4	96.4	NS	0.78
Av.	(Non-sign.)	93.1	90.1	90.5	95.6	97.2	98.3	93.7	94.3	96.4	88.2	---	--
Grand average		95.6	98.9	97.0	99.5	103.8	102.5	99.4	102.5	103.8	91.1	---	--

[a] Differences required for significances between means -- Odds 19 : 1

An analysis of Group I leads to a non-significant F value and therefore no significant difference between the means are indicated. Group II, however shows a highly significant F value and the difference required for significance at the 5% point is found to be 4.6 seedlings. In this group, therefore, all treatments except Yellow Cuprocide at 1% significantly improved emergence.

In addition to the complete tests, 5 tests including only single dosages of each fungicide were conducted with the following results:

Report from		Emergence from seed treated with					
Test No.	Locality	Yellow Cuprocide 2.0%	Arasan 0.5%	Ceresan 1.0%	Non-treated	Sign. Diff.	Calc. "F"
01 b	Calif.	147	141	165	138	N.S.	2.68
01 c	Calif.	182	176	179	65	19.1	167.69
01 d	Calif	49	99	125	16	32.3	21.55
22 b	Mass.	170	171	176	166	N.S.	1.40
36 b	N. Y.	132	128	121	102	N.S.	0.70

Test 01 b, c, and d were conducted in greenhouse flats while 22 b and 36 b were planted in the field. The soil in test 01 b was lightly and in test 01 c moderately infested with Pythium ultimum, while the soil in test 01 d was heavily infested with Rhizoctonia solani. The results of tests 01 c and 01 d indicate that the 3 materials were about equally effective against Pythium but Cuprocide was less effective against Rhizoctonia than Arasan or Ceresan.

The chief causal organisms were reported from 3 of the complete tests. Test 13 (Ill.) was planted in soil artifically infested with Pythium ultimum and most of the seedlings were infected by this fungus although about 10% of the seedlings were infected by Rhizoctonia. In test 44 (Pa.) Pythium was most abundant but Rhizoctonia was also present while in test 48 (S.D.) Pythium debaryanum was reported as the causal organism.

Previous cooperative tests with garden beets in 1940 and 1941 showed significant benefits from seed treatment in about 60% of the tests. The low incidence of infection in 1943 may be due to environmental conditions or to chance alone but the writer has secured evidence that the strain of Detroit Dark Red used in these tests is less susceptible to Pythium damping-off than several other strains of garden beets and sugar beets. This difference may be due to inherited resistance or to differences in rates of emergence which seemed to be related to the severity of preemergence damping-off.

Conclusions. - Only 3 of the 19 complete tests and 2 of the 5 minimum tests produced significant results but the averages of combined tests indicated that all 3 materials, Yellow Cuprocide, Arasan and Ceresan, were beneficial. In some tests the higher dosages of Yellow Cuprocide appeared to reduce emergence as was reported from the 1941 tests for Red Cuprocide but the differences were in most cases non-significant. Arasan appeared to be a favorable seed treatment for garden beet seed and these results indicate a dosage of about 0.5% to be satisfactory. Ceresan was also effective but

this material would have certain limitations for use in home gardens or for pre-treatment of seeds.

Differences, in general, were too small to justify definite conclusions concerning either materials or dosages from these tests.

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VIII. TOMATO SEED TREATMENTS

S. P. Doolittle

The 1943 trials of seed protectants for tomato were designed to determine the actual value of certain treatments now in general use and to compare them with others of more recent introduction which appear to have definite value.

The seed was treated at one point and distributed to the cooperators, who planted 5 replications of 100 seeds each in randomized blocks. The data were taken on a basis of total emergence and analysed statistically by a standard method.

The tomato tests consisted of 15 trials in different localities in 10 States. Nine were planted in the greenhouse and 6 in the field. Six of the greenhouse trials were in soil that was known to be infested with *Pythium* spp. or was artifically infested before planting. Two of the field tests were lost because of unfavorable weather and insect injury.

The treatments used were as follows: Yellow Cuprocide (1.5% by weight of seed); Arasan (0.3%); Spergon (0.3%); seed soaked 5 minutes in a 1-1200 "dip" of New Improved Ceresan; and seed soaked 1 hour in a solution of 2 ounces of copper sulfate in 2 gallons of water.

Table 26 shows the locations of the trials, planting dates, soil types, environmental conditions, and average number of days required for emergence.

Table 26. Location, time of planting, and environmental conditions for 15 cooperative tomato seed treatment tests conducted in 1943

Report from: Test no.	State	Planting date	Soil conditions: pH	Moisture	Soil type	Rainfall	Air temperature: Max.-Min.	Days to emerge
						In.	°F.	
01	Calif.[a]	2/9	6.8	Opt.	Fine sandy loam	--	80-37	14
06	Fla.	2/27	7.0	Opt.	Fine sandy loam	4.50	83-32	10
11	Ga.	5/17	5.5	Opt.	Norfolk sandy loam	1.50	98-52	16
13	Ill.[a]	4/21	--	Wet	Sandy loam	--	---	7
20.1	Md.[a]	4/8	5.6	Opt.	Sandy loam	--	89-60	9
20.1a	Md.[a]	4/28	5.8	Opt.	Sandy loam	--	90-67	10
34	N.Y.	4/26	6.5	Opt.	Sandy loam	4.45	85-44	17
35	N.Y.[a]	4/14	6.0	Opt.	Loam	--	---	13
36	N.Y.[a]	3/3	7.0	Opt.	Silt loam	--	75-63	8
36a	N.Y.[a]	5/14	6.8	Opt.	Silt loam	--	75-67	7
44	Pa.[a]	4/16	6.8	Opt.	Clay loam, 1/4 sand	--	85-62	10
52	Wash.	5/25	6.0	Opt.	Sandy loam	1.23	79-38	--
54	Wash.[a]	4/24	6.0	Opt.	Palouse loam, 1/3 peat	--	---	7

[a] Seed planted in greenhouse

Table 27. Effect of seed treatment on emergence of tomato seedlings.

Report from: Test no.	State	Emergence from seed treated with: New Imp. Ceresan	Yellow Cuprocide	$CuSO_4$	Arasan	Spergon	Untreated check	Least sign. diff.[a]	Calculated "F" value
		%	%	%	%	%	%	%	
A. Significant tests									
01	Calif.	26.6	40.8	35.8	40.0	35.6	30.6	4.44	13.22
06	Fla.	23.0	55.4	71.4	53.2	48.6	58.8	16.38	8.19
13	Ill.[b]	57.8	67.6	66.8	35.0	17.6	20.4	18.99	7.40
20.1	Md.[c]	66.0	69.2	79.2	78.2	70.4	55.6	17.66	7.70
35	N.Y.	41.6	39.0	38.2	42.4	35.8	31.4	5.42	4.7
36	N.Y.[b]	77.0	79.4	86.6	82.0	85.4	82.2	4.56	2.19
36a	N.Y.[b]	74.2	72.8	77.0	75.8	83.4	61.4	8.87	5.76
44	Pa.[b]	72.6	84.0	87.0	83.0	64.0	48.8	5.5	60.9
52	Wash.	74.0	66.2	74.8	73.6	54.6	34.0	15.54	8.99
54	Wash.	64.6	61.6	69.8	61.2	35.6	34.8	12.8	15.16
Average (sign. tests)		57.7	63.6	68.6	62.4	53.1	45.8	---	---
B. Non-significant tests									
11	Ga.	28.8	34.2	30.0	43.2	32.0	31.4	NS	1.94
20.1a	Md.[c]	66.2	77.8	81.0	79.6	76.6	74.8	NS	1.79
34	N.Y.	45.6	65.2	63.2	61.8	57.8	54.0	NS	2.25
Average (non-sign. tests)		46.8	59.0	58.0	61.5	55.4	53.4	--	---
Grand Average		55.2	62.5	66.2	62.2	53.6	47.5	--	---

[a] At 5% point.
[b] Soil known to be infested with *Pythium* spp.
[c] Soil artificially infested with *Pythium* spp.

Table 28. Relative value of different protectants in improving emergence from tomato seed

Treatment used	Number of times a given treatment (Column 1) was superior to: Yellow Cuprocide	$CuSO_4$	Arasan	Spergon	New Imp. Ceresan	Untreated check	Total[a] score
Yellow Cuprocide	---	1	1	4	1	7	14
$CuSO_4$	1	---	2	5	4	8	20
Arasan	0	0	---	5	4	7	16
Spergon	1	0	0	---	3	5	9
New Improved Ceresan	0	0	1	5	---	7	13
None	0	0	0	0	2	---	2

[a] Maximum value 50

The data on seedling emergence and their statistical significance are given in Table 27. Table 28 shows the number of tests in which seedling emergence for any one treatment was significantly better than that for any one of the other treatments and indicates the relative values of the various treatments in this set of tests.

All treatments gave stands significantly better than the checks in 3 of 10 trials (in nos. 36a, 44, and 52). Four of the 5 treatments were effective in 3 other trials (nos. 01, 35, and 54). In only 4 trials (in 06, 11, 20.1a, and 34) was there no significant advantage from at least one treatment.

The copper sulfate soak, Yellow Cuprocide, and the Arasan dust seemed slightly superior to the other treatments, but New Improved Ceresan was also quite effective. Spergon seemed to be somewhat less valuable but was fairly effective in several trials.

The New Improved Ceresan dip showed some reduction in germination and in 2 trials fell below the checks. This seemed to be due to chemical injury to the seed rather than to lack of protection. There is always some retardation of emergence with this material but stands rarely are as seriously reduced as in the 2 instances mentioned. Both of these were on light, sandy soil. In the remaining trials the reduction in stands would not have been of economic importance.

It would seem that Yellow Cuprocide, copper sulfate, and Arasan may be especially valuable as protectants. New Improved Ceresan is so valuable as a combined protectant and disinfectant that it also ranks close to the other 3 in spite of its tendency to delay emergence. Where surface disinfection is not desired, it would be less desirable.

Preliminary Tests of Seed Disinfectants For Tomatoes

Preliminary trials were made with tomato seed known to be contaminated with the organism causing bacterial canker and with seed thought to carry a surface contamination of <u>Alternaria solani</u>. Both lots of seed were treated as follows: Hot water, 52°C. for 30 minutes; 50°C. for 30 minutes; and a 1-1200 New Improved Ceresan dip for 5 minutes. The seed carrying bacterial canker was tested in 4 localities in the greenhouse. A trace of infection occurred with the untreated seed in 2 trials. This infection was too slight to warrant conclusions as to the value of the treatments. In one trial the hot water treatments did not appreciably reduce emergence below the checks, but New Improved Ceresan caused a marked reduction. In another trial with this seed, the New Improved Ceresan treatment caused a slight reduction. A third trial with another lot of seed showed a reduced emergence for the hot water treatments as compared with the New Improved Ceresan or the check. This probably was due to the age of the seed.

In 4 trials with a single lot of seed thought to be infested with <u>Alternaria solani</u>, there was no evidence of leaf or stem infection in any plants. No marked difference in emergence occurred with any treatment in 3 of the 4 trials. In the fourth no data are available on stand. These trials were conducted in localities other than those in which seed protectant trials with New Improved Ceresan gave much reduced stands.

BUREAU OF PLANT INDUSTRY, SOILS, AND AGRICULTURAL ENGINEERING, AGRICULTURAL RESEARCH ADMINISTRATION, U. S. DEPARTMENT OF AGRICULTURE, BELTSVILLE, MD.

IX. ONION SEED TREATMENTS

A. G. Newhall

Seed treatments for onion have been developed primarily as substitutes for the formaldehyde soil treatment used against smut. They have also proved effective in preventing damping-off, so they may be used to advantage in many areas where smut is not a major problem. Since the very heavy dosages (75-100%) required for smut control are undoubtedly superfluous for damping-off, 2 different sets of treatments were prepared for the 1943 cooperative tests and distributed according to the disease problems prevalent in different areas.

A. Tests for Smut Control

The 4 seed treatments listed in Table 29 were compared to 3 soil treatments for Early Yellow Globe onions by 10 different cooperators. Arasan and Fermate were chosen as the dust treatments since salts of the carbamic acid and related compounds have proved more effective against onion smut than other materials. Thiosan was used interchangeably with Arasan in some tests since it contains the same active ingredients (50% tetramethyl-thiuram disulfide) and had not given significantly different results in preliminary tests.

Table 29. Treatments applied to Early Yellow Globe onion seed in smut control tests.

Material	Rate employed
1. Arasan	100% (by weight)
2. Arasan	75% " "
3. Fermate	100% " "
4. Fermate	75% " "
5. Liquid Formaldehyde	1% at 15 cc per foot of row
6. Liquid Catex	2% " " " " " " "
7. Liquid Catex	2.5% " " " " " " "
8. Check	

The dust treatments were applied before the seed was distributed. Since it is difficult to secure adherence of such heavy dosages of material, each pound of seed was first treated with 70 cc of rosin-potash sticker[1]. The seed were then shaken in a large flask with the required

[1] The sticker was prepared by dissolving 90 gms of Grade K gum rosin (Resinous Products Chemical Co., Washington Square, Philadelphia) in 700 cc of boiling potash solution containing 17 gms of KOH. An alternate sticker can be prepared with 1 part of potash to 6 parts of FF wood rosin (Crystal Soap & Chemical Co., Tacony, Pa.). Powdered resins with diluents are unsatisfactory.

amount of dust until all of them were thoroughly coated. After the seed had dried, enough of each treatment was distributed to each cooperator for 5 replications of 100 seeds each. Enough untreated seeds were included for the control and the 3 soil treatments: 1% formaldehyde, 2% catex (an alkaline distillate of southern pine stumps), and 2.5% catex. The solutions were dripped on the seed at the rate of 15 cc per foot of row by the cooperator before covering the seed.

Table 30. Cooperators and conditions in onion smut control tests.

Code no.	State	Cooperator	Location of test	Soil type	Notes
10.	Ill.	M. B. Linn	Field	Sandy loam	Too wet at sowing time
17.1	Mass.	T. Sproston Jr. & O. C. Boyd	Field	Heavy silt loam	Rained in 2 hrs. after sowing
19.1	Mich.	Ray Nelson	Field	Muckland	Too wet. May rainfall 10 in.
29.	N.Y.	A. G. Newhall	Greenhouse	Muckland	Excessive smut
29.1	N.Y.	Wm. D. Rader	Greenhouse	Muckland	Excessive smut
29.1	N.Y.	Wm. D. Rader	Greenhouse	Muckland	Excessive smut
30.1	Oreg.	P. W. Miller & F.P.McWhorter	Greenhouse	Acid peat	Moderate smut
43.	Wis.	W. J. Hooker & J. C. Walker	Greenhouse	Silt loam	Excessive smut

Results: Ten tests were made by cooperators under the conditions described in Table 30. There was a significant difference in emergence in 9 of the 10 tests (Table 31) and in the percentage of smut infection in 8 of the tests (Table 32). All treatments decisively reduced the severity of smut infection. In half of the tests one or more of the dusts gave better results than formaldehyde, while in the remaining tests formaldehyde was superior. The efficiency of the liquid treatments may have been impaired by heavy rainfall since poor results were reported from Massachusetts where rain fell within 2 hours after planting and from Michigan, New York, and Illinois where exceptionally moist conditions prevailed. Pooling the data by the method of Roessler and Leach showed 5 tests (most of which were greenhouse trials in heavily infested soil under conditions of moderate moisture) to constitute a homogeneous group. In this group, the liquid treatments were slightly more effective than the dusts (Table 33). Of the dust treatments, Fermate used at 100% appeared to give the best smut control. Growers on muckland, however, would prefer a brighter colored dust.

There was evidence in several tests that the lower dosages of dusts were adequate. However, if smut is abundant in the soil, the maximum dosage is to be preferred according to the data (Table 34) furnished by a cooperator who tested Fermate at reduced dosages in a well randomized, replicated greenhouse test employing muck soil. The reduced dosages may be economical in lightly infested fields, but other factors such as depth of sowing, soil type, moisture, and speed of germination would have

Table 31. Effect of treatments for onion smut on the emergence or stands of seedlings approximately a month after sowing.

Report from Test no.	State	Emergence from seed treated with Fermate 100%	Fermate 75%	Formaldehyde 1%	Thiosan 100%	Thiosan 75%	Catex 2%	Catex 2.5%	Check	F value	Least sign diff. 5% - 1%	Error var.
10	Ill.	64.4	68.0	60.6	59.4[b]	62.2[b]	54.8	61.1	44.2	6.9	0.8- 1.0	0.37
17.1	Mass.[a]	100.2	101.0	92.3	97.7	100.0	83.9	85.6	78.6	4.1	12.5-16.8	3359.9
19.1	Mich.[a]	51.4	59.7	46.5	51.8[b]	59.2[b]	46.6	51.4	47.3	2.6	18.8-25.5	212.4
28	N.Y.	64.8	74.2	68.2	74.8	63.6	71.0	67.4	57.6	2.4	15.0-20.3	134.9
29.1	N.Y.(a)	83.4	85.8	79.0	85.0	81.6	77.8	81.4	69.4	11.8	4.4- 5.9	11.8
29.1	N.Y.(b)	72.5	73.5	60.3	72.3[b]	69.0[b]	59.5	64.8	53.5	4.2	7.7-10.4	36.5
30.1	Oreg.	89.0	89.4	87.2	90.2	84.6	87.0	88.0	88.8	0.35	NS	18.2
43	Wis.	72.4	68.4	65.8	25.6	22.4	8.0	15.2	15.8	94.9	8.0-10.9	38.9
Totals		598.1	619.1	559.9	556.8	542.6	488.6	514.9	455.2			
Average		74.8	77.4	70.0	69.6	67.8	61.1	64.4	56.9			

[a]Massachusetts data coded by dividing by 6 and Michigan data by dividing by 2, since 600 and 200 seeds, respectively, were sown in each replicate

[b]Arasan used in these tests

Table 32. Mean percentages of onion smut, and significances in 8 experiments.

Report from Test no.	State	Percentage of infection from seed treated with Formaldehyde 1%	Fermate 100%	Fermate 75%	Arasan 100%	Arasan 75%	Catex 2%	Catex 2.5%	Check	F value	Least sign. diff. 5%	1%
10	Ill.	18.40	9.80	34.20	13.60	38.00	47.80	32.00	61.60	56.8	6.67	8.99
17.1	Mass.	6.70	0.47	0.61	0.55	0.56	5.47	4.69	31.62	69.9	3.66	4.94
19.1	Mich.	13.10	3.70	11.71	3.40	3.03	9.18	10.59	29.36	14.2	6.60	8.91
29	N.Y.	3.37	14.38	22.38	16.20	15.94	6.70	9.28	64.30	98.3	5.64	7.62
29.1	N.Y.(a)	11.72	19.88	21.58	28.96[a]	26.73[a]	5.84	7.11	68.40	45.7	8.55	11.53
29.1	N.Y.(c)	3.20	12.86	15.00	24.14[a]	24.56[a]	8.60	6.60	84.62	44.3	8.67	11.70
30.1	Oreg.	3.09	15.31	16.53	1.29[a]	12.72[a]	7.22	18.50	32.14	1.7	NS	
43	Wis.	51.16	28.32	30.22	48.04[a]	55.40[a]	75.56	65.06	94.76	7.0	24.34	32.83
Average		13.84	13.09	19.03	17.02	22.12	20.80	19.23	58.35			

[a]In these tests Thiosan was used in place of Arasan.

Relative scores or values of seed treatments (maximum score = 49)

Formaldehyde 1%	Fermate 100%	Fermate 75%	Arasan 100%	Arasan 75%	Catex 2%	Catex 2.5%	Check
19	20	15	15	12	16	16	0

Table 33. Combined analysis of 5 homogeneous sets of data on onion smut control.

Report from Test no.	State	Check	Thiosan 100%	Thiosan 75%	Fermate 100%	Fermate 75%	Formaldehyde 1%	Catex 2%	Catex 2.5%	Total	Error variances
29.1	N.Y.(a)	68.4	28.9	26.7	19.9	21.6	11.7	5.8	7.1	190.1	43.56
29	N.Y.(b)	64.3	16.2*	15.9*	14.4	22.4	3.4	6.7	9.3	152.6	19.01
29.1	N.Y.(c)	84.6	24.1	24.6	12.8	15.0	3.2	8.6	6.6	179.5	44.84
19.1	Mich.	29.4	3.4*	3.0*	3.7	11.7	13.1	9.2	10.6	84.1	26.03
17.1	Mass.	31.6	0.6*	0.6*	0.5	0.6	6.7	5.5	4.7	50.8	8.00
Total		278.3	73.2	70.8	51.3	71.3	38.1	35.8	38.3	657.1	141.44
Av. Mean		55.6	14.6	14.1	10.3	14.3	5.6	7.2	7.6	131.4	28.288

F. value = 223

LDM for Sign.: 5% -- 2.97
1% -- 4.16

* Arasan used in place of Thiosan in these tests.

Table 34. Effect of reduced dosage rates of dust on smut control (W. E. Rader, Ithaca, N.Y.)

	Treatment and dosage rates	Mean % smut
Check		84.6
1.	Fermate straight 20% by weight	34.1
2.	Fermate straight 33.3% by weight	26.1
3.	Fermate straight 50% by weight	23.7
4.	Fermate straight 100% by weight	12.8
1a.	Fermate plus talc 1:4 at 1:1 of seed = 20% Fermate	25.6
2a	Fermate plus talc 1:2 at 1:1 of seed = 33.3% Fermate	21.2
	Fermate plus talc 1:1 at 3/4:1 of seed = 37.5% Fermate	17.7
3a	Fermate plus talc 1:1 at 1:1 of seed = 50% Fermate	15.0
Formaldehyde 1% at 15cc per foot of row		3.2
Catex 2% at 15 cc per foot of row		8.6
Catex 2.5% at 15 cc per foot of row		6.6

LD for Sign.: 5% -- 8.9
1% -- 11.9

Table 35. Percentage of smut control with Fermate, Arasan, and Thiosan

Seed treatment	Smut infection %
Fermate 100%	14.4
Fermate 75%	22.4
Arasan 100%	16.2
Arasan 75%	15.9
Thiosan 100%	13.1
Thiosan 75%	32.5
Check	64.3

L.D.Sign.: 5% -- 3.7; 1% -- 4.9

to be considered in deciding upon the minimum effective dosage. There is some evidence (Table 34) that a certain amount of talc diluent with Fermate may improve its effectiveness if the dosage is not reduced too much, but more work along this line is needed before arriving at a final conclusion.

In one of the New York greenhouse tests, Thiosan, Arasan, and Fermate were all compared at the 100% and 75% levels. The mean percentages of smut infection are given in Table 35. In this test Fermate appeared significantly better than Thiosan but perhaps not better than Arasan, and reduced dosages of Fermate and Thiosan were significantly less effective. A comparison between the degree of smut control obtained by the cooperators using Arasan and those using Thiosan, when corrected for the different amounts of smut in the 2 groups of checks, indicated that the 2 treatments were not significantly different. This also appeared to be true in field tests conducted on many muckland farms of New York in 1943.

In one of the tests (no. 28) conducted on a muck field where 23% smut infection occurred on untreated seed, emergence was increased over check by all treatments, especially by Thiosan 100% and Fermate 75%. Survival to harvest time was significantly improved by all treatments with Thiosan 100% and formaldehyde, giving significantly better results than either of the Fermate treatments or Thiosan 75%. Catex 2.5% also resulted in better survival than Fermate 100% and Thiosan 75%. Final yields were increased significantly by all treatments (Table 36). Thiosan 100% gave larger increases than Thiosan 75% and Fermate 100%. Formaldehyde gave the second-best yield but the improvement over the remaining treatments was not significant. In this and the only other test (no. 10) where yield records were taken, Thiosan seemed to be fully as good as formaldehyde (Table 36).

Table 36. Yield of onions (pounds per 10 feet of row) from 2 seed treatment tests.

Report from: Test no.	State	Yield of marketable onions: Check	Thiosan 100%	Thiosan 75%	Fermate 100%	Fermate 75%	Formaldehyde 1%	Catex 2%	Catex 2.5%	F value	L.D. sign. 5%	L.D. sign. 1%
10	Ill.	6.3	23.4*	18.1*	23.4	18.9	22.5	9.3	18.4	12.0	5.3	7.1
28	N.Y.	3.7	10.6	7.3	7.5	8.1	10.2	8.7	9.0	85.0	3.0	4.1
Totals		10.0	34.0	25.4	30.9	26.0	32.7	18.0	27.4			
Average		5.0	17.5	12.7	15.4	13.0	16.3	9.0	13.7			

* Arasan used in this experiment.

In Oregon, Calomel at 100% and a mixture of Calomel-Fermate at 100% were included in a test on acid peat. Neither gave appreciable control over the check.

Discussion of Smut Control Tests

1. It is difficult to draw valid conclusions as to which treatment was superior because of variation in results in different localities.
2. It is probably safe to say that no treatment consistently showed ability to control smut better than liquid formaldehyde under all conditions, but that under certain conditions Catex did nearly as well, and both dusts at the heavier rates of application gave yields equal to those obtained with formaldehyde.
3. If rain falls soon after sowing, dust treatments apparently suffer less than liquid treatments from the resulting dilution.
4. The dust seed treatments were practically as effective as liquid treatments except where the smut infestation was abnormally severe, as in greenhouse soils. The reduced dosages of dusts seemed to be particularly inadequate under these conditions. Careful tests should be run before recommending seed treatment at a dosage of less than 100%.
5. The expense of dust treatments operates against their adoption on farms where seed is shown at very heavy rates (60 to 90 lbs. per acre), but the convenience of sowing dust-treated seed may give it a place on farms where bulbs are grown for table use and liquid treatment is especially objectionable.

B. Damping-Off Control

Five tests were made under the conditions described in Table 37 with the following treatments: Thiosan 2%, Fermate 1.5%, Spergon 2%, Semesan 0.25%, yellow Cuprocide 1%, and zinc oxide 4%. Significant differences were obtained between treatments in 4 of the 5 tests as shown in Table 38.

Table 37. Cooperators and conditions in onion seed treatment tests for damping-off control.

Code no.	Locality	Cooperator	Location of test	Soil type	Notes
06	Ga.	W. D. Moore	Field	Sandy loam	500 seed replicates
06A	Ga.	W. D. Moore	Field	Sandy loam	500 seed replicates
14	Iowa	R. H. Porter	Greenhouse	Sand	4 replicates
17	Mass.	E. F. Guba & E.V.Seeler, Jr.	Field	Gravelly loam	Used Catex also
45	Brit.Col.	Irene Mounce	Greenhouse	Compost	

In 1 outdoor test at Waltham, Massachusetts, Arasan was substituted for Thiosan, Yellow Cuprocide was left out, and formaldehyde 1%, Catex 2%, and Catex 2.5% were added as soil treatments. The liquid treatments gave no control, Fermate and Semesan increased the stand significantly, while zinc oxide and Arasan very nearly did. The failure of Catex to control damping-off is in line with similar tests conducted at Cornell

Table 38. Mean stands of onions in 5 seed treatment tests for damping-off control.

Test no.	Locality	Thiosan	Fermate	Yellow Cuprocide	Semesan	Zinc oxide	Spergon	Check	F value	L.S. diff. 5% - 1%
06	Ga.*	184.1	182.7	183.8	177.7	168.1	168.0	168.4	1.5	NS
06a	Ga.*	281.7	230.7	221.9	209.3	229.3	201.2	208.1	3.5	47.0-66.0
14	Iowa	90.5	86.0	88.2	81.2	83.2	79.0	63.5	6.4	9.4-12.8
17	Mass.	82.4	87.0	[+]86.5	84.6	83.4	[+]82.8	78.4	4.6	5.9- 8.0
45	Brit.Col.	88.0	88.6	83.0	83.6	69.8	70.0	65.6	13.1	7.7-10.5
Average		145.3	135.0	132.7	127.3	126.7	120.2	116.8		
Relative scores of treatments		11	5	5	4	1	1	0	Maximum score = 24	

* In Georgia 500 seed samples were sown per replicate.

[+] Figures for Yellow Cuprocide and Spergon were missing in this experiment and were supplied for this table by treating part of it as a randomized block after the method of Love, which makes them only approximations.

where its use as a soil drench for this purpose has not met with success.

Conclusions on Damping-off Control Tests

Thiosan 2% appeared to control damping-off better than the other materials, although Fermate 1.5% did as well in 3 of the 4 tests in which significant differences occrred. Yellow Cuprocide was a close third, its efficacy not being significantly below that of Fermate. A glance at Table 31 indicates that Fermate may be slightly better than the other treatments also.

X. POTATO SEED DISINFECTANTS

C. N. Clayton

Results from the 1942 cooperative tests on disinfection of potato seed tubers indicated that treatment with mercurial compounds frequently failed to increase stands or yields and that an effective non-injurious treatment was needed.

In 1943 the objective was to determine the relation of various mercurial and organic toxicants as disinfectants of seed potatoes to stand, control of Rhizoctonia, seedpiece-decay, green weight of plants, and yield. Cooperators located in 11 States made 15 cooperative field trials. The cooperators were: M. B. Linn, Illinois; R. W. Samson, Indiana; C. V. Kightlinger, Massachusetts; R. S. Davidson and C. J. Eide, Minnesota; J. A. Pinckard, Mississippi; G. L. McNew, New York; J. H. McLaughlin and H. B. Cordner, Oklahoma; F. L. Howard, Rhode Island: C. N. Clayton, South Carolina; C. J. Gould and T. E. Randall, Washington; and G. H. Starr, Wyoming.

Each cooperator applied 5 assigned treatments and 3 unassigned treatments (of the cooperator's choice) to whole tubers of certified seed of the variety suited to his locality. Unless stated otherwise, the treatments were applied by immersing the tubers for approximately 1 minute in an aqueous solution or suspension of 1 pound of treating material in 7-1/2 gallons of water.

The treatments were: (1) no treatment (control); (2) Semesan Bel; (3) Yellow oxide of mercury 2oz. to 7-1/2 gals. water; (4) Wettable Spergon; (5) Fermate; (6), (7), and (8) unassigned.

Three of the following treatments were chosen as unassigned treatments by each cooperator:

(a) Thiosan
(b) Mercuric chloride, 1 oz. to 7-1/2 gals. water, 90 min. soak
(c) Mercuric chloride, 1-1/2 oz., plus commercial hydrochloric acid, 0.6 pint to 7-1/2 gals water, 5 min. soak.
(d) Wettable Sulfur, Stauffer's Magnetic-Spray (98%S), 15 lbs. to 7-1/2 gals. water.
(e) Formalin (40% formaldehyde) 0.4% by volume, 90 min. soak.
(f) USR #604 (20% dichloro-naphthoquinone), 1-1/2 lbs to 7-1/2 gals.
(g) Quartol (dimethyl ethanol octodecylammonium chloride), 0.02% by volume.
(h) DL1 (dimethyl di(dodecyl) ammonium chloride), 0.02% by volume.
(i) Imularv (dimethyl benzyl dodecyl ammonium chloride, 20% aqueous solution) 5.0% by volume.
(j) Sanoseed Potato Dip (7.9% ethanol mercuric chloride).
(k) Sinox (sodium dinitro ortho cresol) 2% by volume.
(l) Sinox 1% by volume, 10 min. soak.
(m) Sulfur dust.

Following treatment, the tubers were allowed to dry. In some tests the tubers were cut into seedpieces and planted promptly after treatment, whereas in other tests several weeks elapsed before planting.

In each test a randomized block was used with 5 replicates of each treatment. Each plot consisted of a single 50-foot row and contained 50 seedpieces for yield and stand data plus an additional 10 seedpieces for data on seedpiece decay, Rhizoctonia infection of the plant stems, and green weight per plant. The data from the extra 10 seedpieces in each plot were obtained by removing and examining the plants when they were about 8 inches tall.

In Table 39 are given test number, location, variety, stage of sprout development when treated, percentage of seedpieces with Rhizoctonia sclerotia and with scab lesions on the surface, dates of treating, planting, and harvesting, and soil type, reaction, and moisture condition at planting.

Table 39. Location, variety, and environmental conditions of potato seed treatment tests -- 1943

Report from: Test no.	State	Variety	Seedpieces with Rhizoctonia	Seedpieces with Scab	Date Treated[a]	Date Planted	Date Harvested	Soil Moisture	Soil pH	Soil Type
			%	%						
13	Ill.	Irish Cobbler	35	40	4/2	5/1	9/30	Opt.	6.1	Clay loam
15	Ind.	Katahdin	95	5	5/13	6/11	10/7	Opt.	6.0	Silt loam
15a	Ind.	Katahdin	95	5	5/13	6/15	10/16	Opt.	5.2	Muck
23	Mass.	Chippewa	46.5	28.5	5/10	5/14	Oct.	Opt.	5.3	Merrimac
25	Minn.	Early Ohio	0.5	1.8	4/13	4/16	8/3	Opt.	5.8	Loamy sand
25a	Minn.	Bliss Triumph	50	0	5/8	5/10	9/23	Opt.	--	Silt loam
25b	Minn.	Red Warba	0	0	5/22	6/7	9/16	Opt.	--	Clay loam
28	Miss.	---	18.5	--	--	Late	--	--	6.7	---
28a	Miss.	---	18.5	--	--	Late	--	--	5.5	---
36	N.Y.	Katahdin	15	6	5/20	6/10	10/4	Opt.	7.3	Silt loam
42	Okla.	Bliss Triumph	44.5	3.5	3/5	3/12	6/24	Dry	5.3	Sandy loam
45	R.I.	Irish Cobbler	5	<1	4/21	5/17	8/27	Wet	5.2	Sandy loam
46	S.C.	Irish Cobbler	13	4	2/11	2/12	5/27	Opt.	5.9	Sandy loam
53	Wash.	White Rose	35.5	66	4/29	5/1	9/15	Opt.	--	Sandy loam
58	Wyo.	Bliss Triumph	50	50	--	--	--	--	--	---

At time of treating, eyes of tubers were dormant in tests 36 and 45; sprouts were just starting in tests 23 and 25; 1/8 in. long in 15, 15a, 25b, 42, and 46; and 1/4 in. long in tests 13 and 53. Whole tubers were used in tests 15 and 45.

[a]No injury from treatment occurred except that in test 13 mercuric chloride caused delayed sprouting and in test 23 some pitting of surface of tuber; and in tests 28 and 28a Sinox injured the sprouts.

Table 40. Relation of disinfection of seed potatoes to percentage of seedpieces producing plants -- 1943

Report from: Test no.	State	Mean percentage stand from seedpieces treated with: Control	Semesan Bel	HgO	Wet. Spergon	Fermate	Thiosan	Wet. Sulfur	$HgCl_2$ HCl	$HgCl_2$	[a]Unassigned	Diff. req. sign.	Calc. "F" value
15	Ind.	98.4	96.4	98.8	97.2	98.4	98.8	96.8	--	--	e=84.4	4.9	8.02
23	Mass.	95.2	94.4	94.0	88.0	96.0	--	--	76.0	82.8	j=88.8	7.3	7.7
25a	Minn.	95.2	96.0	94.0	92.0	92.2	93.6	93.6	86.0	--	--	4.6	3.85
36	N.Y.	90.0	89.2	83.6	92.0	94.4	87.2	88.4	--	--	f=83.6	7.9	2.63
46	S.C.	98.2	89.8	94.0	96.0	96.0	96.0	--	90.6	--	i=87.2	5.4	4.21
53	Wash.[b]	55.4	54.6	55.0	49.0	56.6	55.8	--	--	50.4	m=55.6	3.8	4.47
13	Ill.	69.2	59.6	59.6	58.4	61.6	56.8	--	62.4	--	e=64.0	NS	0.85
15a	Ind.	96.4	93.6	94.0	91.6	93.6	93.2	94.8	-- ?	--	e=93.6	NS	0.64
25	Minn.	88.4	93.6	93.6	91.6	92.4	93.6	91.2	90.4	--	--	NS	0.30
25b	Minn.	82.4	88.8	91.6	86.4	79.6	83.6	71.6	84.8	--	--	NS	0.49
42	Okla.	91.2	89.6	91.2	95.2	89.6	91.2	--	--	92.4	e=86.0	NS	1.95
45	R.I.	100.0	100.0	99.2	99.6	99.6	100.0	--	--	--	g=99.6 h=99.6	NS	0.64
58	Wyo.	96.0	98.0	99.2	99.2	99.6	98.0	99.2	--	--	e=98.4	NS	1.41
Average for sign. tests except 53		95.4	93.2	92.9	93.0	95.4	--	--	--	--	--		

[a]See page 46 for treatments indicated by the letters

[b]Average no. of plants from 50 seedpieces per plot rather than percent of seedpieces producing plants.

Table 40A. Number of tests in which the average percentage stand for any one treatment is significantly higher than that for each other treatment, and relative value of the treatments for the significant tests.

Treatment	Number of tests in which the treatment in the first column is better than: Control	Semesan Bel	HgO	Wettable Spergon	Fermate	Relative value of treatments[a]
Control	--	1	0	1	0	2
Semesan Bel	0	--	0	1	0	1
Yellow oxide of mercury	0	0	--	1	0	1
Wettable Spergon	0	1	1	--	0	2
Fermate	0	1	1	2	--	4

[a]Maximum value for any treatment is 20

Table 41. Relation of disinfection of seed potatoes to control of Rhizoctonia lesions on stems of plants -- 1943

Report from: Test no.[a]	State	Mean Rhizoctonia index[a]: Control	Semesan Bel	HgO	Wet. Spergon	Fermate	Thiosan	Wet. Sulfur	$HgCl_2$:HCl	$HgCl_2$	[b]Unassigned	Diff. req. sign.	Calc. "F" value
13	Ill.	0.22	0.13	0.22	0.23	0.22	0.25	--	0.10	--	e=0.056	0.096	48.9
15a	Ind.	0.47	0.11	0.03	0.41	0.53	0.47	0.39	--	--	e=0.608	0.122	22.1
36	N.Y.	1.08	1.14	0.97	0.63	0.24	0.43	1.05	--	--	f=0.809	0.557	3.0
45	R.I.	0.23	0.13	0.15	0.28	0.33	0.30	--	--	--	g=0.42 h=0.30	0.158	3.1
53	Wash.	0.31	0.14	0.40	0.25	0.20	0.44	--	--	0.09	m=0.330	0.204	3.1
23	Mass.	0.78	0.88	0.52	0.93	0.35	--	--	0.73	1.15	j=0.534	NS	2.0
25	Minn.	0.16	0.12	0.17	0.15	0.17	0.18	0.21	0.12	--	---	NS	1.8
25a	Minn.	0.26	0.13	0.16	0.26	0.23	0.16	0.24	0.14	--	---	NS	2.3
25b	Minn.	0.20	0.20	0.20	0.20	0.17	0.22	0.20	0.21	--	---	NS	0.3
42	Okla.	0.40	0.25	0.35	0.29	0.36	0.34	--	--	0.32	e=0.274	NS	0.9
46	S.C.	0.04	0.00	0.00	0.00	0.00	0.01	--	0.00	--	i=0.030	NS	2.2
Average for sign. tests		0.46	0.33	0.36	0.36	0.30	0.38						

[a]Each of 10 plants per plot, according to the amount of Rhizoctonia infection of stem or rhizomes, was assigned into one of 5 classes: 0=no infection; 1=slight shallow reddish discoloration; 2=considerable shallow reddish lesions; 3=sunken lesions; 4=complete girdling or decay of stem or rhizomes. Rhizoctonia index for each plot calculated by multiplying the number of plants in each class by the number of the class, total those products and divide by 4x the number of plants examined.

[b]See page 46 for treatments indicated by the letters.

Table 41A. Number of tests in which the mean Rhizoctonia index for one treatment is significantly less than that for each other treatment, and relative value of the treatments for the significant tests.

Treatment	Number of tests in which the treatment in the first column was better than: Control	Semesan Bel	HgO	Wettable Spergon	Fermate	Thiosan	Relative value of treatments[a]
Control	--	0	0	0	0	0	0
Semesan Bel	2	--	1	2	3	4	12
Yellow Oxide of mercury	1	0	--	1	2	2	6
Wettable Spergon	0	0	0	--	0	0	0
Fermate	1	1	1	0	--	1	4
Thiosan	1	1	0	0	0	--	2

[a]Maximum value for any treatment 25

Table 42. Relation of disinfection of seed potatoes to seedpiece decay -- 1943

Test no.	State	Control	Semesan Bel	HgO	Wet. Spergon	Fermate	Thiosan	Wet. Sulfur	$HgCl_2$ HCl	$HgCl_2$	[a]Unassigned	Diff. req. sign.	Calc. "F" value
		Percentage of seedpiece decay from seed treated with											
13	Ill.	12.0	2.0	10.0	20.0	26.0	10.0	--	10.0	--	e=14.0	11.8	3.18
15a	Ind.	10.6	6.0	0	11.0	2.0	6.6	36.4	--	--	e= 2.2	7.4	21.1
25a	Minn.	28.0	14.0	2.0	12.0	8.0	36.0	68.0	4.0	--	--	19.4	10.7
25b	Minn.	21.6	0.8	3.2	14.8	0.4	1.2	30.2	2.0	--	--	5.9	32.1
36	N.Y.	62.0	46.0	30.2	69.4	66.6	80.0	73.0	--	--	f=71.6	22.3	4.5
23	Mass.	4.6	4.4	7.4	8.0	6.6	--	--	15.4	16.0	j= 7.2	NS	0.9
42	Okla.	0	2.0	4.0	4.0	4.0	10.0	--	--	0	e= 2.0	NS	0.6
45	R. I.	0	0	0.0	2.0	2.0	0	--	--	--	g= 0 h= 0	NS	0.8
46	S.C.	0	0	0	0	0	6.0	--	--	--	i= 0	NS	1.0
Average for: sign. tests		26.8	13.8	9.1	25.4	20.6	26.7	51.9					

[a]See page 46 for treatments indicated by the letters

Table 42A. Number of tests in which the average percentage seedpiece decay for one treatment is significantly less than that for each other treatment, and relative value of the treatments for the significant tests.

Treatment	Control	Semesan Bel	HgO	Wettable Spergon	Fermate	Thiosan	Wettable Sulfur	Relative value of treatments[a]
	Number of tests in which the treatment in the first column was better than							
Control	---	0	0	0	1	0	3	4
Semesan Bel	1	---	0	2	1	2	4	10
Yellow oxide of mercury	4	0	---	3	2	2	4	15
Wettable Spergon	1	0	0	---	0	1	3	5
Fermate	3	0	0	2	---	1	3	9
Thiosan	1	0	0	1	1	---	3	6
Wettable Sulfur	0	0	0	0	0	0	---	0

[a]Maximum value is 29 for any treatment except Wettable Sulfur for which it is 24

Table 43. Relation of disinfection of seed potatoes to green weight of plants, 1943

Test no.	State	Control	Semesan Bel	HgO	Wet. Spergon	Fermate	Thiosan	Wet. Sulfur	HgCl2: HCl	HgCl2	Unassigned	Diff. req. sign.	Calc. "F" value
		Mean green-weight (grams) per plant[a]											
25	Minn.	31.7	36.2	34.4	30.9	30.0	30.9	31.7	28.1	--	--	4.55	2.62
25b	Minn.	48.3	63.0	55.6	56.3	65.5	55.6	48.3	62.2	--	--	8.15	5.0
36	N.Y.	192.9	194.9	199.5	251.1	207.2	200.3	207.2	--	--	f=219.1	28.6	3.67
42	Okla.	52.8	79.6	57.2	75.2	55.8	63.8	--	--	69.2	e= 70.8	15.1	3.49
45	R.I.	89.7	72.5	61.6	94.2	95.1	94.2	--	--	--	g=100.6	18.5	5.0
											h=103.3		
46	S.C.	43.9	38.5	33.5	48.0	46.7	48.5	--	37.1	--	i= 35.3	9.5	3.25
13	Ill.	18.2	19.9	18.7	18.5	21.2	19.1	--	22.9	--	e= 20.2	NS	0.5
23	Mass.	37.0	35.3	41.4	41.4	42.6	--	--	43.7	40.9	j= 40.9	NS	0.2
25a	Minn.	43.6	50.0	59.0	51.8	53.6	47.0	45.3	47.0	--	--	NS	1.3
53	Wash.	64.9	53.9	46.5	55.0	57.3	55.8	68.6	--	45.4	--	NS	1.7
Average for sign. tests		76.6	80.8	73.6	92.6	83.4	82.2						
Average for all tests		62.3	64.4	60.7	72.2	67.5	--						

[a] Green-weight of plants, without attached seedpieces, that were removed for data on Rhizoctonia infection

Table 43A. Number of tests in which the mean green-weight of plants for one treatment is significantly greater than that for each other treatment and relative value of the treatments for the significant tests.

Treatment	No. of tests in which the treatment in first column is better than: Control	Semesan Bel	HgO	Wettable Spergon	Fermate	Thiosan	Relative value[a] of treatments
Control	--	1	2	0	0	0	3
Semesan Bel	2	--	1	1	2	2	8
Yellow oxide of mercury	0	0	--	0	0	0	0
Wettable Spergon	2	4	3	--	2	1	12
Fermate	1	1	3	0	--	1	6
Thiosan	0	2	2	0	0	--	4

[a] Maximum value for any treatment is 30

Table 44. Relation of disinfection of seed potatoes to yield of U.S.No. 1 tubers -- 1943.

Report from: Test no.	State	Average yield (lbs.) of No. 1 potatoes: Control	Semesan Bel	HgO	Wet. Spergon	Fermate	Thiosan	Wet. Sulfur	$HgCl_2$	$HgCl_2$ HCl	[a]Unassigned	Diff. req. sign.	Calc. "F" value
25b	Minn.	43.7	53.0	41.2	39.3	47.2	44.3	34.0	46.0	--	--	10.2	2.57
28	Miss.	6.6	6.1	4.1	6.9	3.7	--	--	--	4.5	k= 0.7 l= 1.0	5.3	16.86
28a	Miss.	11.4	7.2	10.7	12.9	16.8	--	--	--	10.5	k= 1.2 l= 1.9	8.5	42.60
36	N.Y.	32.8	34.9	38.5	28.6	29.1	29.1	32.3	--	--	f=34.1	5.2	3.69
42	Okla.	14.5	12.5	14.1	17.9	12.2	15.0	--	--	19.5	e=14.0	3.2	5.19
53	Wash.	11.5	12.9	13.3	9.7	5.7	3.8	--	--	7.0	m= 8.1	5.6	3.17
13	Ill.	1.7	1.4	1.8	2.1	1.8	1.3	--	1.7	--	e= 2.0	NS	0.9
15	Ind.	27.1	25.0	26.8	25.3	25.5	26.3	24.8	--	--	e=24.0	NS	0.6
15a	Ind.	34.8	34.7	31.7	37.3	33.2	29.9	35.1	--	--	e=36.6	NS	0.76
23	Mass.	57.7	62.4	59.4	53.9	58.1	--	--	63.5	53.3	j=53.9	NS	0.36
25	Minn.	94.0	94.4	98.8	101.1	90.0	92.4	104.8	84.7	--	--	NS	1.04
25a	Minn.	34.3	34.9	35.8	32.0	33.5	30.1	34.2	34.0	--	--	NS	0.65
45	R.I.	22.2	21.3	23.2	21.0	22.7	21.2	--	--	--	g=22.6 h=24.9	NS	1.70
46	S.C.	31.4	29.8	30.1	29.2	27.6	29.8	--	26.0	--	i=27.5	NS	1.06
58	Wyo.	53.2	52.8	55.6	55.6	50.4	51.4	49.4	--	--	e=55.8	NS	1.03
Average for: sign. tests		20.1	21.1	20.3	19.2	19.1	--	--	--	--	--		
Average for: non-sign. tests		39.3	39.6	40.4	39.7	38.1	--	--	--	--	--		
Average for: all tests		31.8	32.2	32.3	31.5	30.5	--	--	--	--	--		

[a]See page 46 for treatments indicated by the letters

Table 44A. Number of tests in which the average yield for one treatment is significantly better than that for each other treatment, and relative value of the treatments for the significant tests.

Treatment	Number of tests in which the treatment in the first column was better than: Control	Semesan Bel	HgO	Wettable Spergon	Fermate	Thiosan	Relative value of treatments[a]
Control	--	0	0	0	1	1	2
Semesan Bel	0	--	1	2	2	2	7
Yellow oxide of mercury	1	0	--	1	2	2	6
Wettable Spergon	1	1	1	--	1	1	5
Fermate	0	1	0	0	--	0	1
Thiosan	0	0	0	0	0	--	0

[a]Maximum value is 28 for any treatment except Thiosan for which it is 20

Effect of Seed Treatment on Stand of Plants. Table 40 contains a summary of the stand data from 13 tests after they had been analyzed as randomized block experiments. Only 6 of the 13 tests were significant at the 5% point. The data of final stand counts in Table 40 are summarized in Table 40A to show in how many of the 6 significant tests each assigned treatment is significantly better than each other treatment and also to indicate the relative values of the treatments in affecting stands. The relative values obtained by totaling the number of tests in which the individual treatments were significantly better than the other treatments indicate that no treatment was significantly better than the control in any test, and that Semesan Bel, yellow oxide of mercury, Spergon, and Fermate did not differ greatly in their effect upon stand. It should be noted that in several of the tests in which mercuric chloride or acid-mercuric chloride was used a significant reduction in stand resulted in comparison with the untreated control.

Since early stand counts record more clearly any delay in emergence that may result from treatment than do final stand counts, such data were taken in tests 25, 25a, 25b, 42, and 46. Only 2 of the 5 tests were significant. Acid-mercuric chloride and yellow oxide of mercury in both tests, and Semesan Bel, Fermate, and Imularv in one test, had significantly lower stands than did the untreated.

Effect of Seed Treatment on Rhizoctonia Stem Infection. Data on Rhizoctonia infection (Table 41) on the stems of plants from 10 seedpieces from each plot were taken in 11 tests, 5 of which were significant. The Rhizoctonia control data are summarized in Table 41A to show in how many of the 5 significant tests each treatment is significantly better than each other treatment and also to indicate the relative values of the treatments in controlling Rhizoctonia infection. A significant reduction in Rhizoctonia infection was attained in 2 tests with Semesan Bel and in 1 test each with yellow oxide of mercury, Fermate, and Thiosan.

Effect of Seed Treatment on Seedpiece Decay. Data on seedpiece decay (Table 42) were taken on the 10 seedpieces per plot that were removed for the Rhizoctonia-control data. Five of the 9 tests were significant. The summarized data (Table 42A) show that yellow oxide of mercury and Semesan Bel were the most effective treatments in reducing the amount of seedpiece decay, whereas Wettable Sulfur increased it.

Effect of Seed Treatment on Green Weight of Plants. Since disease control, injury, or stimulation by treatment could be reflected in the green weight of the plants, such data (Table 43) were taken in 10 tests on the plants removed for data on Rhizoctonia infection. Data from 6 of the 10 tests were significant and are summarized in Table 43A. The data seem to indicate that Wettable Spergon may have been stimulatory, for the increase in green weight per plant from its use can not be attributed to Rhizoctonia control as might be the case with Semesan Bel.

Effect of Seed Treatment on Yield. The yield data for the 15 tests, 6 of which are significant, are summarized in Tables 44 and 44A. Among the reasons for low yields in several tests were late planting, drought, or insect damage. In only 2 tests did any treatment significantly increase the yields of No. 1 tubers in comparison with the control. In test 42 Spergon and mercuric chloride were better than the control and in test 36 yellow oxide of mercury was better. The relative values for Semesan Bel,

Table 45. Relation of disinfection of seed potatoes to control of Rhizoctonia and scab on tubers -- 1943

Report from: Test no.	State	Rhizoctonia	Scab: "F" value	Scab: Diff. req. sign.	Scab index[a]	
13	Ill.	None	1.7	NS		
15	Ind.	None	8.1	2.7	Control	0
					Semesan Bel	5.2
					HgO	5.1
					Spergon	0.5
					Fermate	2.0
					Thiosan	1.0
					Formalin	6.8
					Wet. Sulfur	0.2
15a	Ind.	Slight to moderate infestation of small sclerotia on all tubers	4.4	4.7	Control	10.1
					Semesan Bel	10.3
					HgO	11.9
					Spergon	5.4
					Fermate	3.9
					Thiosan	4.2
					Formalin	8.5
					Wet. Sulfur	3.2
23	Mass.	Not significant	1.7	NS		
25	Minn.	None	Slight scab on tubers from all plots			
28	Miss.	None	Uniformly serious			
28a	Miss.	None	Uniform on all tubers			
25b	Minn.	Not significant		NS		
36	N.Y.	None	Trace of scab on tubers from all plots			
42	Okla.	None	No scab			
45	R.I.	"F" value 3.08; only HgO and DL1 sign. better than control	1.01	NS		
46	S.C.	None	No scab			
53	Wash.	Not significant "F" value 1.9	No scab			

[a]The scab index for tests 15 and 15a was calculated by dividing the yield of each plot into scab-free, slightly, moderately, and severely scabbed classes; assigning numerical values of 0, 1, 2, or 3 to those classes; then multiplying the weight of tubers in each class by the class value. The sum of the resulting values was then divided by 3 x the total weight of tubers examined and then multiplied by 100.

yellow oxide of mercury, and Wettable Spergon were slightly higher than that for the control, Fermate, or Thiosan.

Effect of Seed Treatment on Amount of Rhizoctonia and Scab on Tubers. Data on Rhizoctonia control on tubers (Table 45) were taken at harvest by assigning the lot of potatoes from each plot, according to the estimated amount of tuber surface covered with sclerotia of the fungus, into one of the following classes: 0, no sclerotia; 1, a trace; 2, slight; 3, moderate; or 4, severe. Sclerotia on tubers were reported in 5 of 11 tests. In only 1 test did any treatment significantly reduce the amount of Rhizoctonia; in that test yellow oxide of mercury caused the reduction.

Data on control of common scab (Table 45) were taken at harvest by assigning the lot of potatoes from each plot, according to the estimated amount of tuber surface covered with scab lesions, into the following classes: 0, no scab; 1, a trace; 2, slight; 3, moderate; or 4, severe. Scab infection occurred in 10 of 13 tests. However, scab infection data were significant only in the 2 tests from Indiana, scab being significantly reduced by Spergon, Fermate, Thiosan, or Wettable Sulfur in one test and significantly increased by Semesan Bel, yellow oxide of mercury, or formalin in the other. The yield of scab-free No. 1-size tubers for Wettable Spergon in test 15a was significantly higher than for the control, Semesan Bel, yellow oxide of mercury, or Thiosan. In test 15 the yield of scab-free No. 1-size potatoes for the control was the highest of any treatment although only that for formalin was significantly lower than the control.

Summary of Potato Seed Treatment Data for 1943. Summarizing, the data indicate that for yield the relative value of Semesan Bel, yellow oxide of mercury, or Wettable Spergon was only slightly higher than that of the control; for stand, the untreated control was best; for control of seed-piece decay, yellow oxide of mercury was highest, Semesan Bel and Fermate being next; for control of Rhizoctonia on stems, Semesan Bel was highest, yellow oxide of mercury and Fermate being next; for green weight per plant, Wettable Spergon was highest, Semesan Bel and Fermate next in order.

In general, the data tend to support the results of the 1942 trials, which indicated that disinfection of seed potatoes is frequently not profitable.

SOUTH CAROLINA TRUCK EXPERIMENT STATION, CHARLESTON

XI. SNAP BEAN SEED TREATMENTS

J. C. Walker and W. W. Hare

Seed of Green Refugee beans were treated in a rotary seed treater with the following materials: Spergon at 0.2% (0.5 oz. per 15 lbs. of seed); Fermate at 0.2%; and Arasan at 0.125%.

Five replications of 100 seed each from these treated lots and from an untreated control were sown under field conditions in the localities described in Table 46. The planting dates, soil type, reaction, and moisture at time of planting, precipitation, minimum and maximum daily temperatures from planting to average date of emergence, and average number of days from planting to emergence are also given in Table 46.

Table 46. Location, time, and environmental conditions of green bean seed treatment tests in 1943.

Report from: Test no.	State	Planting date	Soil: Type	Soil: pH	Soil: Moisture	Rainfall	Air temperature: Min.Max.	Days to emerge
						In.	°F.	
11	Ga.	5/8	Clay	5.6	Dry	2.08	43-98	13
28c	Miss.	4/2	Ockfocknee	5.7	Opt.	0.87	43-89	8
52	Wash.	5/19	Sandy loam	5.7	Dry	0.83	37-76	--
28b	Miss.	4/21	Sandy loam	6.7	Opt.	0	39-85	6
6	Fla.	1/29	Fine sandy loam	6.5	Opt.-dry	0.28	28.3-83.4	11
36	N.Y.	6/16	Silt loam	7.3	Dry	1.74	59-96	13
57b	Wis.	4/21	Silt loam	6.2	Opt.	1.38	28-81	19
12	Idaho	5/21	Silt loam	6.9	Opt.	--	38-76	9
57a	Wis.	5/20	Silt loam	6.2	Very wet	0.43	46-80	8
51	Va.	5/6	Silt loam	5.9	Opt.	2.49	54-96	11
28a	Miss.	4/1	---	--	Dry	0.06	48-88	10
22	Mass.	5/6	Sandy loam	5.9-6.0	Opt.	2.42	34-85	13
44	Pa.	5/6	Clay loam	6.8	Opt.-dry	2.65	42-86	9
47	S.C.	4/22	Sandy loam	5.8	Opt.	1.61	42-88	7
17	Iowa	5/8	Clay loam	6.8-7.2	Opt.	--	---	--

In Table 47 are the data from the various localities showing the average number of seedlings for each treatment, calculated F value, and the minimum difference in the means required for significance. It may be seen that there were significant differences in only 3 of the 15 tests and each treatment was significantly better than the check in 2 of the 3 locations.

Table 47. Summary of individual seed treatment tests with Green Refugee beans; analyzed as randomized block tests.

Test no.	Average number of seedlings: Spergon	Fermate	Arasan	Check	Calculated F value	MSD
11	52.8	52.0	55.8	56.8	---	NS
28c	48.2	55.8	54.2	49.2	0.82	NS
52	76.4	74.0	74.0	74.4	0.09	NS
28b	70.4	72.6	70.0	63.4	1.05	NS
6	75.8	79.0	70.6	82.0	2.14	NS
36	71.4	74.6	78.6	71.8	1.34	NS
57b	65.2	64.2	67.0	61.0	0.91	NS
12	77.6	81.2	82.8	78.0	1.07	NS
57a	79.2	79.4	83.8	81.4	0.94	NS
51	85.2	86.2	86.0	87.6	0.26	NS
28a	87.8	91.2	89.0	88.6	0.781	NS
22	84.8	88.4	87.6	81.4	4.13	4.8
44	89.2	87.4	89.2	83.0	3.58	4.75
47	93.8	88.4	85.4	83.8	11.2	4.05
17	83.0	83.4	86.6	84.0	2.55	NS

Table 48. Summary of group analyses of tests with Green Refugee beans in 1943.

No. of locations	Average number of seedlings: Spergon	Fermate	Arasan	Check	Average error var.	F value	MSD
14	77.71	78.63	78.91	76.76	35.20	1.887	NS

In Table 48 are the data from a group analysis of the combined tests (method of E. B. Roessler and L. D. Leach). When test 11 was omitted the remaining 14 tests formed a homogeneous group. It may be seen that there were no significant differences in the combined analysis.

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XII. CUCUMBER SEED TREATMENTS

S. P. Doolittle

The cucumber trials were conducted in 8 States. The seed was treated with Yellow Cuprocide (1.5%), Arasan (0.3%), and Spergon (0.3%). (All percentages are by weight of seed). Four of the trials were made in the greenhouse and 5 in the field. Data were based on total emergence and 7 of the 9 tests gave significant results. The other 2 tests were lost through weather and insect damage.

Table 49. Location, time, and environmental conditions for 9 cooperative cucumber seed treatment tests conducted in 1943

Report from: Test no.	State	Planting date	Soil conditions: pH	Moisture	Soil type	Rainfall	Air temperature: Max.-Min.	Days to emerge
						in.	°F.	
13	Ill.	4/21[a]	--	Wet	Sandy loam	--	--	5
20.1a	Md.	4/8[a]	5.8	Opt.	Sandy loam	--	89-60	6
20.1b	Md.	4/28[a]	5.8	Opt.	Sandy loam	--	90-67	5
24	Mich.	6/1	6.8-7.2	Opt.	Sandy loam	--	--	6
31	N.J.	7/17	5.6	Opt.-dry	Sassafras loam	0.39	92-61	5
36	N.Y.	6/19	7.4-7.9	Opt.	Silt loam	0.96	96-46	9
44	Pa.	5/17	6.2	Opt.	Clay loam	1.97	89-50	11-13

[a]Planted in greenhouse

Table 50. Effect of seed treatment on emergence of cucumber seedlings.

Report from: Test no.	State	Emergence from seed treated with: Yellow cuprocide	Semesan	Arasan	Spergon	Untreated check	Least sign. diff.[a]	Calculated "F" value
		%	%	%	%	%		
13	Ill.[b]	73.4	68.0	79.6	62.6	42.2	8.68	24.38
20.1	Md.[b]	79.8	78.8	83.2	81.6	62.8	4.56	29.67
20.1a	Md.[b]	71.0	74.6	71.8	69.2	56.2	7.48	8.27
24	Mich.	25.8	23.6	24.8	23.2	12.8	8.13	3.76
31	N.J.	62.5	57.4	65.8	63.4	57.6	6.40	3.02
36	N.Y.	59.4	53.4	62.0	61.8	48.2	5.72	9.90
44	Pa.[b]	65.8	68.8	63.0	57.2	60.4	3.24	17.40
Average		62.5	59.2	64.2	59.8	48.6	---	---

[a]At 5% point
[b]Soil known to be infested with *Pythium* spp.

Table 51. Relative value of different protectants in improving emergence from cucumber seed

Treatment used	Number of times a given treatment (Column 1) was superior to: Yellow Cuprocide	Semesan	Arasan	Spergon	Untreated check	Total score[a]
Yellow Cuprocide	--	2	0	1	6	9
Semesan	0	--	1	1	5	7
Arasan	0	3	--	2	6	11
Spergon	0	1	0	--	5	6
None	0	0	0	0	--	0

[a]Maximum value 28

Table 49 gives the locations of the tests, dates of planting, soil types, environmental conditions, and average number of days required for emergence in the different trials.

The data on seedling emergence and their statistical significance are shown in Table 50. Table 51 shows the number of tests in which any given treatment was significantly superior to any one of the other treatments and furnishes a basis for determining the relative value of any of the treatments in this set of tests.

In 4 of the 7 trials (in Nos. 13, 20.1, 20.1a, and 24), all of the treatments gave significant increases in stand as compared with the untreated checks. In all trials, at least one of the treatments gave a significant increase. Arasan appeared to be the most effective treatment but the differences between it and Semesan and Yellow Cuprocide were not great; and Spergon, while somewhat less effective in the present tests, gave significant increases in stand in 5 of the 7 trials.

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XIII. SWEETPOTATO SEED TREATMENTS

C. J. Nusbaum

Dip treatments have been recommended for sweetpotatoes primarily for protection against such seed-borne diseases as black rot (*Ceratostomella fimbriata*), scurf (*Monilochaetes infuscans*), and stem rot (*Fusarium batatatis* and *F. hyperoxysporum*). These treatments also give some measure of control of such seedbed organisms as *Pythium* sp., *Sclerotium rolfsii*, and *Rhizoctonia*.

An 8 to 10 minute soak in 1-1000 mercuric chloride is generally recommended throughout the sweetpotato belt. Semesan Bel is also recommended and widely used in some areas. Although mercurial disinfectants have been satisfactory generally, in many cases delayed or reduced sprout production has been encountered as a result of their use. Therefore, increasing attention has been given to substitutes in the search for less critical materials which will give equal or better performance than mercury compounds. In recent tests by Dr. H. T. Cook and Dr. L. L. Harter, borax has shown promise as a sweetpotato seed treatment material, especially in the control of black rot. Interest has also been shown in Fermate. Spergon has been reported to be effective against stem rot in Kansas and New Jersey and against sclerotial blight in South Carolina but was disappointing in Virginia and Mississippi. In the introductory tests for 1943 it seemed advisable to limit the number of treatments to 4, with the intention of expanding the program to include other promising substitute materials, if the first year's results warranted continuance of the work on a cooperative basis. The treatments chosen for 1943 follow:

1. Fermate 1 lb. plus hydrated lime 1 lb. to 12-1/2 gal. water*
2. Mercuric chloride 1-1000**
3. Semesan Bel 1 lb. to 7-1/2 gal. water*
4. Borax 1 lb. to 6 gal. water***
5. Check, untreated.

* Instantaneous dip, bedded dry
** 8-minute soak, bedded wet
*** 10-minute soak, bedded wet.

Because of the difficulties involved in standardizing the procedures for a cooperative test involving diseased material, it was decided that, in the beginning at least, apparently healthy seed should be used. Attention was to be centered upon the effect of the treatments upon sprout production and the control of sprout and seedpiece decay.

In 1943, the test was conducted by only 2 cooperators. The Louisiana strain of the Porto Rico sweetpotato was designated for each test but this variety was not available in Virginia. Therefore the Maryland Golden variety was substituted. The results are shown in Tables 52, 53, and 54.

Table 52. Location, time, and environmental conditions under which sweetpotato seed treatment tests were conducted.

Report from: Test no.	State	Planting date	Planted in	Soil type	pH	Moisture	Temperature[a] 5 p.m.	Temperature[a] 8 a.m.	Rainfall	Days to emerge	Total duration
							°F	°F.	In.		days
47	S.C.	3/19	Bed[b]	Sandy loam	5.8	Dry	76.5	60.0	3.24[c]	31-39	67
51	Va.	3/30	Frame[d]	Sand	6.3	Dry	75.4	67.1	2.99[e]	49-50	84

[a] Average of daily soil temperature readings taken throughout total duration

[b] Manure-heated bed, covered with cloth March 19 to April 1, covered with glass April 1 to May 3, uncovered thereafter.

[c] Watered 11 times in addition to precipitation shown

[d] Coldframe, covered with sash until May 17, uncovered thereafter.

[e] Watered 3 times weekly until sash were removed.

Table 53. Effect of seed treatment on yield of sweetpotato sprouts.

Report from: Test no.	State	Variety	Sprouts pulled from seed treated with[a]: Fermate-lime	Mercuric chloride	Semesan Bel	Borax	Check (untr.)	Diff. req. sign.	Calc. "F" value
A. Mean Number of Sprouts									
47	S.C.	Porto Rico	1013.0	747.7	742.7	983.2	764.0	161.2	6.16
51	Va.	Maryland Golden	410.5	300.5	342.5	390.5	326.0	NS	1.89
B. Mean Weight of Sprouts in Grams									
47	S.C.	Porto Rico	4222.2	3041.8	3223.4	4040.6	3450.0	735.5	4.50
51	Va.	Maryland Golden	2567.5	1398.7	2005.0	1942.5	2127.5	437.5	8.71

[a] Sprouts pulled 3 times. Each treatment was replicated 4 times and each replicate consisted of 1/2 bu. (25 lbs.) of seed potatoes bedded in 1 sq. yd. of bed space. To obtain yield per bu. multiply by 2

SUMMARY. Although only 2 tests were conducted in 1943, the results indicate that both Fermate plus lime and borax treatments are promising as substitutes for the mercurials, especially if further investigation shows them to be effective against seed-borne diseases. With the Porto Rico variety both substitutes were significantly better than the check and the 2 mercury compounds in sprout production. The same trend was noted in the test with the Maryland Golden variety where the data did not meet the requirements for statistical significance, except with regard to weight of sprouts produced.

Table 54. Effect of seed treatments on sweetpotato bed diseases

Report from: Test no.	State	Variety	Incidence of disease from seed treated with: Fermate-lime	Mercuric chloride	Semesan Bel	Borax	Check (untr.)
A. Total Diseased Sprouts[a]							
47	S.C.	Porto Rico	0	0	0	0	16
51	Va.	Maryland Golden	4	2	9	9	7
B. Total Decayed Seed Roots[b]							
47	S.C.	Porto Rico	35	18	27	52	90
51	Va.	Maryland Golden	61	84	84	67	78

[a] 16 decayed sprouts in Porto Rico check showed Sclerotium rolfsii. Other cases undetermined.

[b] After last sprout pulling, "mother" seed roots dug up and examined. Cause of decay not determined.

In the case of the Maryland Golden variety there was practically no difference in the time of sprout emergence for any of the treatments. With Porto Rico, however, the mercury treatments exhibited marked delay. The average number of days from bedding to emergence for the Porto Rico variety was as follows: Fermate plus lime 31.7; borax 33.2; check, 33.2; Semesan Bel 37.0; and mercuric chloride 38.2.

With the Maryland Golden variety, seed treatment apparently had very little effect upon the incidence of sprout disease or decay of the seed roots. Aside from 2 small foci of Sclerotium rolfsii infection in the check plots, the Porto Rico sprouts appeared to be healthy. With this variety, however, all treatments reduced the incidence of root decay and the mercurials excelled in this respect. In both tests the incidence of seed root decay was quite high. However, the rolê it played in reducing sprout production was not determined.

SOUTH CAROLINA AGRICULTURAL EXPERIMENT STATION, EDISTO SUBSTATION, BLACKVILLE

XIV. CORN SEED TREATMENT TESTS FOR CENTRAL AND NORTHERN STATES REGION

George Semeniuk

In the winter of 1943 a corn seed-treatment subcommittee of the American Phytopathological Society was organised for the Central and Northern States Region. The purpose was to conduct a coordinated seed-treatment study within this region. The program followed was to determine the protection offered the corn seed and seedling from soil-borne pathogens by different fungicidal dusts. The identity of the soil-borne pathogens was investigated, and also the influence that various soil and climatic factors might have upon the incidence of disease.

Varieties used:

1. Illinois Hybrid 960 which in Iowa tests conducted by Dr. C. S. Reddy over a period of years has shown consistent benefits from seed treatment.
2. A compounded mixture of seeds of 10 commercially grown hybrids (obtained from a mid-western producer of hybrid corn) to obtain an "average" response to seed treatment.

Seed treatments:

1. Semesan Jr., 1-1/2 oz. per bu.
2. Barbak D (6% mercuric phenyl cyanamide), 1-1/2 oz. per bu.
3. Spergon, 1-1/2 oz. per bu.
4. Arasan (DuBay 1205-AL), 1 oz. per bu.
5. No treatment.

For uniformity, measured quantities of Illinois hybrid 960 and each of the 10 commercial hybrid seeds enough for all plantings at all stations were treated at one time and place. The treated seed was stored in tight containers for 24 hours before counting and packeting. Quantities of 100 seeds were counted out (which in the case of the mixed hybrids consisted of 10 kernels from each of the 10 hybrids treated alike), packeted and distributed to the various cooperators. Field plantings were made with 6 replications, 100 kernels to the 16-1/2 foot row, rows spaced 1 foot apart. The varieties with their split-plots of 5 treatments were alternated randomly. Plantings on different dates were made in adjacent areas. The test locations and cooperators were as follows:

State	Location of test within State	Cooperator
1. South Dakota	Brookings	W. F. Buchholtz
2. Minnesota	St. Paul	M. B. Moore
3. Iowa	Ames	G. Semeniuk
4. Missouri	Columbia	C. M. Tucker
5. Wisconsin	Madison	P. E. Hoppe
6. Illinois	Urbana	B. Koehler
7. Indiana	Lafayette	A. J. Ullstrup
8. Ohio	Wooster	J. D. Wilson

Table 55. Soil and climatic conditions under which corn seed treatment tests were conducted.

State	Planting date	Soil condition: Type	Soil condition: pH	Soil condition: Moisture	Prevailing temperatures[a] Min. Max.	Total rainfall[a]	Days to emerge
					°F.	in.	
S.D.	5/5				35.5-63.0[b]	0.34	
	5/24				51.5-74.6	1.20	
	6/3				49.3-69.8	3.34	
Minn.	4/28	Hempstead		21.8%	44.9-59.2[c]	2.59	21
	5/4	silt		24.2%	47.5-62.4	2.68	19
	5/11	loam		26.5%	48.8-61.1	2.96	16
	5/20			24.9%	56.4-68.5	2.78	12
Iowa	4/22	Webster		Opt., 28.4%	41.9-67.0[b]	2.20	12
	5/2	silty	5.2	Wet, 33%	44.0-64.9	3.24	14
	5/13	clay		Wet, 37%	47.1-64.5	1.98	11
	5/22	loam		Wet, 33%	49.8-73.1	0.79	8
	6/19			Opt.-	67.8-90.2	0.95	4
Mo.	4/28			Opt.			
	5/5			Wet			
	6/2			Wet			
	6/14			Opt.			
Wis.	4/28			Opt.	41.5-63.6[b]		
	5/14			Wet	43.9-65.4		
Ill.	4/21	Flanagan	5.4	Wet	56.7[b]	2.46	15
	5/3	silt		Wet	59.8	5.15	13
	5/22	loam		Wet	66.4	0.84	8
	6/5			Opt.	69.4	1.34	6
Ind.	4/22	Warsaw		Wet	50.0-66.6[c]	1.85	14
	5/4	silt		Wet	52.5-61.3	10.08	13
	5/14	loam	5.6	Wet	55.9-63.3	6.17	8
	5/26			Opt.	60.4-71.4	0.06	6
	6/5			Wet	60.8-71.1	1.48	6
Ohio	4/26			Opt.	48[c]		
	5/4			Opt.+	52		
	5/14			Wet	56		
	5/26			Opt.	68		
	6/4			Dry	73		

[a] For period from planting to emergence or for 10-day period following planting where days to emergence not given.
[b] Air temperature
[c] Soil temperatures at seed level

Table 56. Average emergence (= percentage) of corn in seed treatment tests.

State	Planting date	Illinois Hybrid 960: Seed treatment: Non-treated	Semesan Jr.	Barbak D	Spergon	Arasan	Diff.[a] for sign.	Mixed Hybrids: Seed treatment: Non-treated	Semesan Jr.	Barbak D	Spergon	Arasan	Diff.[a] for sign.
Minn.	4/28	68.7	84.0	82.5	82.7	92.5	4.97	71.5	83.0	80.7	79.3	84.7	6.13
	5/4	64.8	72.8	63.7	68.0	83.5	6.75	71.3	80.0	74.0	75.2	85.0	3.61
	5/11	66.5	77.5	69.8	75.3	82.8	3.92	71.8	85.0	82.2	82.3	83.2	5.21
	5/20	68.0	80.5	75.5	81.8	87.3	4.79	71.2	80.5	72.5	77.3	85.5	7.30
Iowa	4/22	80.5	94.0	89.5	92.8	94.5	3.85	88.7	90.0	89.2	93.7	88.3	2.24
	5/2	78.3	85.3	85.5	85.8	90.0	5.02	84.3	90.7	88.0	87.7	89.5	3.70
	5/13	76.8	92.8	82.2	91.0	93.7	2.28	82.3	88.7	86.5	89.2	89.0	4.36
	5/22	91.2	96.7	94.0	93.8	95.2	3.24	90.2	92.3	92.8	92.3	91.0	NS
	6/19	96.0	95.7	95.8	94.8	95.2	NS[b]	92.7	93.0	92.8	92.0	93.8	NS
Mo.	4/28	65.0	64.6	64.4	78.8	67.2	NS	65.3	65.7	67.0	74.8	66.2	NS
	5/5	44.5	45.7	44.7	58.8	46.3	8.21	45.5	48.7	47.5	55.0	42.5	7.39
	6/2	82.2	81.3	77.7	86.0	82.7	NS	78.2	80.7	83.3	81.5	81.7	NS
	6/14	81.0	79.3	79.5	83.3	75.3	NS	74.2	73.7	78.8	78.3	77.0	NS
Wis.	4/28	92.0	97.3	93.8	93.5	94.8	NS	84.3	89.7	88.7	89.5	91.7	3.43
	5/14	87.0	92.0	89.8	91.5	94.2	4.26	87.8	91.8	88.8	88.7	86.0	NS
Ill.	4/21	77.8	81.2	80.3	85.5	85.3	NS	69.7	75.0	75.3	78.3	82.2	2.32
	5/3	81.2	88.7	82.8	89.3	89.7	NS	84.5	89.7	89.0	88.5	86.3	NS
	5/22	87.2	84.7	87.5	85.8	85.7	NS	81.8	87.5	83.5	84.8	84.2	NS
	6/5	95.3	89.5	94.7	95.2	97.2	2.78	88.0	84.3	88.2	90.5	89.3	NS
Ind.	4/22	90.7	94.7	95.0	97.2	96.7	2.54						
	5/4	88.3	89.8	90.8	93.5	93.8	NS						
	5/14	90.7	90.0	87.5	93.5	93.2	3.80						
	5/26	91.8	94.8	91.7	94.0	92.5	NS						
	6/5	97.2	97.0	97.8	97.0	97.8	NS						
Ohio	4/26	69.8	87.0	85.3	93.3	93.3	2.39	79.3	85.0	85.0	88.0	88.5	NS
	5/4	89.3	89.3	91.8	88.2	84.7	2.28	88.3	89.0	87.8	86.2	87.8	NS
	5/14	89.2	90.7	89.8	86.3	84.7	4.00	85.7	90.8	85.2	86.0	85.2	NS
	5/24	84.3	86.0	85.7	86.7	82.2	NS	83.3	84.7	84.5	84.8	79.8	NS
	6/4	65.7	74.5	69.3	66.3	62.2	4.99	66.8	70.3	72.3	68.3	72.3	NS
S.D.[c]	5/5	89.7	91.7										
	5/24	95.0	95.7	"t" test nonsignificant									
	6/3	87.7	91.4										

[a] At the 5% level
[b] Nonsignificant
[c] 3 replications only

Table 57. Average percentage emergence of mixed hybrids and Illinois hybrid 960 analyzed as a complex test for corn seed treatment.

State	Planting date	Non-treated	Semesan Jr.	Barbak D	Spergon	Arasan	Diff.[a] for sign.
			Seed treatment				
Minn.	April 28	70.1	83.5	81.6	81.0	88.6	4.86
	May 4	68.0	76.4	68.8	71.6	84.3	3.74
	May 11	69.2	81.3	76.0	78.8	83.0	3.33
	May 20	69.6	80.5	74.0	79.6	86.4	3.93
	All dates	69.2	80.4	75.1	77.8	85.6	1.91
Iowa	April 22	84.6	92.0	89.3	93.2	91.4	2.36
	May 2	81.3	88.0	86.8	86.8	89.9	3.32
	May 13	79.6	90.8	84.3	90.1	91.3	3.30
	May 22	90.7	94.5	93.4	93.1	93.1	2.70
	June 19	94.3	94.3	94.3	93.4	94.5	NS
	All dates	86.1	91.9	89.6	91.3	92.0	1.21
Mo.	April 28	65.2	65.2	65.7	76.8	66.7	4.49
	May 5	45.0	47.2	46.1	56.9	44.4	5.69
	June 2	80.0	81.0	80.5	83.8	82.2	NS
	June 14	77.6	76.5	79.2	80.8	76.2	NS
	All dates	67.0	68.0	68.0	74.4	67.5	2.63
Wis.	April 28	88.2	93.5	91.2	91.5	93.2	2.80
	May 14	87.4	91.9	89.3	90.1	90.1	NS
	All dates	87.8	92.7	90.3	90.8	91.7	2.03
Ill.	April 21	73.7	78.1	77.8	81.9	83.7	4.88
	May 3	82.8	89.2	85.9	88.9	88.0	4.17
	May 22	84.5	86.0	85.5	85.3	84.9	NS
	June 5	91.7	86.9	91.4	92.8	93.2	2.76
	All dates	83.2	85.1	85.2	87.2	87.5	1.89
Ohio	April 26	74.6	86.0	85.2	89.2	90.9	1.30
	May 4	88.8	89.2	89.8	87.2	86.2	1.39
	May 14	87.4	90.8	87.5	86.2	85.0	1.25
	May 24	83.8	85.4	85.1	85.8	81.0	2.65
	June 4	66.2	72.4	70.8	67.3	67.2	3.03
	All dates	80.3	84.7	83.8	83.8	82.1	6.94

[a] At the 5% level.

Table 58. Number of times each treatment is better than any other treatment. Significant and nonsignificant differences taken together.

State	No.[a] of tests	Illinois hybrid 960 Non tr.	Sem. Jr.	Barbak D	Spergon	Arasan	Mixed hybrids Non tr.	Sem. Jr.	Barbak D	Spergon	Arasan	Both groups combined Non tr.	Sem. Jr.	Barbak D	Spergon	Arasan	Max value
Minn.	4	1	11	3	9	16	0	13	5	7	15	0	12	5	7	16	16
Iowa	4	0	11	6	8	15	1	12	9	12	7	0	13	6	8	11	16
Mo.	4	7	5	3	16	9	2	5	13	13	7	3	6	8	16	6	16
Wis.	2	0	7	3	3	7	1	7	4	4	4	0	8	2	4	5	8
Ill.	4	6	4	7	11	12	1	9	8	12	10	2	10	6	11	11	16
Ohio	1	0	2	1	3	3	0	1	1	3	4	0	2	1	3	4	4
Ind.	4	3	7	4	14	12											16
Totals	23	17	47	27	59	74	5	47	40	51	47	5	51	28	49	53	

[a]Number of tests showing general seed treatment benefit

Table 59. Number of times each treatment is significantly better than any other treatment.

State	Number[a] of tests	Nontreated	Semesan Jr.	Barbak D	Spergon	Arasan	Maximum value
			Illinois Hybrid 960				
Minn.	4	0	8	2	4	16	16
Iowa	4	0	7	3	4	8	16
Mo.	1	0	0	0	4	0	4
Wis.	1	0	1	0	1	2	4
Ohio	1	0	1	1	1	1	4
Ind.	1	0	1	1	2	1	4
Totals	12	0	18	7	16	28	48
			Mixed Hybrids				
Minn.	4	0	7	3	3	9	16
Iowa	3	0	2	0	5	2	12
Mo.	1	0	0	0	4	0	4
Wis.	1	0	1	1	1	1	4
Ill.	1	0	1	1	3	4	4
Totals	10	0	11	5	16	16	40
			Both Groups Combined				
Minn.	4	0	8	3	3	15	16
Iowa	4	0	9	4	6	4	16
Mo.	2	0	0	0	8	0	8
Wis.	1	0	1	1	1	1	4
Ill.	2	0	1	0	2	4	8
Ohio	1	0	1	1	3	4	4
Totals	14	0	20	9	23	28	56

[a] Tests showing significant seed treatment benefits

Table 60. Necrosis of mesocotyl and primary roots of maize in the seed treatment tests conducted in Iowa

Date of planting	Illinois Hybrid 960: Seed treatment: Non-treat.	Semesan Jr.	Barbak D	Spergon	Arasan	Diff.[a] for sign.	Mixed Hybrids: Seed treatment: Non-treat	Semesan Jr.	Barbak D	Spergon	Arasan	Diff.[a] for sign.
Percentage of Plants with Necrotic Mesocotyls												
April 22	16.5	13.5	12.3	14.7	17.6	NS[b]	39.8	26.1	18.7	26.4	24.6	6.29
May 2	27.7	19.3	22.0	21.3	19.4	NS	33.7	19.3	25.3	29.3	22.7	NS
May 13	54.0	37.7	43.7	47.3	46.3	10.30	50.3	41.0	48.7	49.7	41.3	NS
May 22	57.7	51.0	56.7	53.3	45.3	NS	64.0	50.0	58.7	54.3	56.7	8.09
June 19	75.3	49.3	88.3	67.7	64.0	8.46	80.7	61.0	86.0	67.3	66.3[illegible]	8.9[illegible]
Severity of Mesocotyl Necrosis[c]												
April 22	7.2	6.4	6.0	6.4	7.1	NS	21.3	14.4	8.2	13.8	13.1	4.67
May 2	13.3	8.3	9.2	9.0	8.0	NS	15.7	9.1	12.4	13.2	10.6	NS
May 13	26.4	17.7	21.6	21.7	22.4	NS	26.3	21.2	23.1	23.7	19.9	NS
May 22	26.9	23.6	27.9	24.4	22.4	NS	33.3	24.7	31.7	29.0	30.7	3.62
June 19	40.3	23.2	49.1	35.4	32.3	3.95	46.4	34.9	49.1	36.3	38.1	8.04
Percentage of Plants with Necrotic Primary Roots												
April 22	8.1	5.8	2.4	5.2	8.1	3.36	23.8	15.3	15.4	34.5	23.0	6.77
May 2	63.2	54.7	54.0	63.7	51.3	NS	70.7	65.9	69.8	68.6	64.3	NS
May 13	80.[illegible]	82.7	81.7	89.7	86.0	NS	92.3	90.7	88.3	95.7	92.3	NS
May 22	86.7	85.0	93.3	86.3	85.0	NS	93.7	89.0	91.7	90.7	94.7	NS
June 19	61.7	49.0	65.7	61.0	56.7	NS	82.0	77.7	77.7	76.0	78.0	NS
Severity of Primary Root Necrosis[c]												
April 22	3.3	1.9	0.9	1.7	3.1	NS	9.9	5.8	6.6	12.8	8.7	3.18
May 2	29.1	23.8	23.2	28.4	22.7	NS	33.4	30.7	35.0	35.3	29.6	NS
May 13	39.6	38.6	41.0	44.6	42.6	NS	56.6	50.4	51.1	54.5	57.2	NS
May 22	46.1	41.0	51.1	44.8	43.1	NS	58.4	52.3	51.4	53.3	57.1	NS
June 19	26.3	18.8	28.3	25.6	23.6	7.54	40.2	35.9	37.6	37.8	37.2	NS

[a] At the 5% level

[b] Nonsignificant

[c] Mesocotyls rated 0, 1, 2, or 3 according to whether they were zero necrotic, trace to 1/3 necrotic, 1/3 to 2/3 necrotic, or 2/3 to completely necrotic, respectively. Primary roots (radicle and seminals) were rated 0, 1, 2, or 3 according to whether there was no necrosis, one to several small necrotic areas on one or more roots, several medium elongated necrotic areas usually on 2 or more roots, much elongated necrotic areas up to complete or nearly complete necrosis of one (radicle)but usally all members of the primary root system, respectively.

Severity of disease determined as:

$$\frac{\text{Sum of ratings given individual plant parts}}{\text{Number of plants examined x 3}} \times 100$$

Table 61. Necrosis of mesocotyl and primary roots of maize in the seed treatment tests conducted in Iowa. Analyzed on a complex test for treatment

Date of planting	Nontreated	Semesan Jr.	Barbak D	Spergon	Arasan	Diff. for sign. 5% level
		Percentage of Plants with Necrotic Mesocotyls				
April 22	28.2	20.0	15.5	20.5	21.1	8.19
May 2	30.7	19.3	23.7	25.3	21.0	7.17
May 13	53.8	39.3	46.2	48.5	43.8	8.89
May 22	60.8	50.5	57.7	53.8	51.0	NS
June 19	78.0	55.2	87.2	87.5	65.2	6.46
All dates	50.3	36.8	46.0	43.2	40.4	3.29
		Severity of Mesocotyl Necrosis				
April 22	14.2	10.4	7.1	10.1	10.1	4.36
May 2	14.5	8.7	10.8	11.1	9.3	4.04
May 13	26.4	19.4	22.4	22.7	21.2	NS
May 22	26.4	24.2	29.8	26.7	26.5	NS
June 19	43.4	29.1	49.1	35.8	35.2	5.11
All dates	25.7	18.3	23.8	21.3	20.5	1.97
		Percentage of Plants with Necrotic Primary Roots				
April 22	16.0	10.5	8.9	19.8	15.5	6.14
May 2	66.9	60.2	61.9	66.1	57.8	NS
May 13	86.2	86.7	85.0	92.7	89.2	5.87
May 22	90.2	87.0	92.5	88.5	89.8	NS
June 19	71.8	63.3	71.7	68.5	67.3	NS
All dates	66.2	61.5	64.0	67.1	63.9	2.92
		Severity of Primary Root Necrosis				
April 22	6.6	3.9	3.8	7.2	5.9	2.52
May 2	31.3	27.2	29.1	31.9	26.2	NS
May 13	48.1	44.6	46.1	49.5	49.9	NS
May 22	52.3	46.7	51.3	49.0	50.3	NS
June 19	33.3	27.3	33.0	31.7	30.4	NS
All dates	34.3	29.9	32.6	33.9	32.5	2.11

Table 62. Mean percentage of plants exhibiting primary root necrosis. Seed treatment tests conducted in Ohio.

Date of planting	Date of examination	Illinois Hybrid 960					Mixed Hybrids				
		Seed treatment					Seed treatment				
		Non-treated	Semesan Jr.	Barbak D	Spergon	Arasan	Non-treated	Semesan Jr	Barbak D	Spergon	Arasan
April 26	June 19	15.0	1.7	11.7	10.0	8.3	10.0	8.3	8.3	8.3	3.3
May 4	June 19	13.3	3.3	5.0	5.0	5.0	13.3	5.0	6.7	6.7	6.7
May 14	June 28	20.0	5.0	13.3	18.3	8.3	16.7	5.0	10.0	5.0	6.7
May 24	July 7	13.3	6.7	5.0	6.7	8.3	15.0	10.0	5.0	6.7	10.0
June 4	July 7	10.0	10.0	3.3	0.0	1.7	8.3	3.3	5.0	1.7	1.7
Mean of all dates		14.3	5.3	7.7	8.0	6.3	12.7	6.3	7.0	5.7	5.7

Table 63. Mean total green weight (lbs.) of plants per plot in corn seed treatment tests conducted in Missouri

Date of planting	Nontreated	Semesan Jr.	Barbak D	Spergon	Arasan	Diff. for signif.-5%
April 28	8.0	8.4	8.3	10.8	10.5	1.85
May 5	7.2	6.4	7.7	9.6	6.9	1.43
June 2	5.8	6.1	5.9	6.2	6.1	NS
All dates	6.9	6.9	7.2	8.8	7.7	0.76

Table 64. Mean green weight (lbs.) per individual plant in the corn seed treatment tests conducted in Missouri.

Date of planting	Nontreated	Semesan Jr.	Barbak D	Spergon	Arasan	Diff. for signif.-5%
April 28	.244	.248	.231	.282	.305	.020
May 5	.352	.323	.381	.361	.350	NS
June 2	.144	.150	.145	.148	.149	NS

Table 65. Mean total green weight (grams) of plants in corn seed treatment tests conducted in Ohio. Analyzed as random blocks.

Date of planting	nontreated	Semesan Jr.	BarbakD	Spergon	Arasan	Diff. for signif.-5%
			Illinois Hybrid 960			
April 26	1983	1959	2169	2260	2465	266.0
May 4	1620	1674	1810	1821	1718	---
May 14	2191	2291	2264	2149	2172	---
May 24	2465	2489	2314	2429	2386	---
June 4	889	1098	883	880	872	97.4
			Mixed Hybrids			
April 26	1724	1794	1935	1867	1842	---
May 4	1692	1489	1676	1565	1549	---
May 14	2022	2114	1993	2096	1942	---
May 24	2376	2550	2438	2523	2437	123.0
June 4	797	784	885	845	870	---

Table 66. Mean number of strong plants in corn seed treatment tests conducted in Illinois. Analyzed as random blocks.

Date of planting	Nontreated	Semesan Jr.	Barbak D	Spergon	Arasan	Diff. for signif.-5%
			Illinois Hybrid 960			
April 21	66.3	72.3	69.8	80.0	76.3	9.30
May 3	74.3	81.7	75.0	83.0	85.2	6.42
May 22	79.3	75.0	80.3	77.2	77.3	---
June 5	88.0	85.3	90.2	89.9	92.2	4.03
			Mixed Hybrids			
April 21	57.2	62.3	63.5	68.5	75.5	6.14
May 3	78.3	83.7	81.8	82.3	78.3	---
May 22	71.2	78.5	74.8	71.3	76.2	---
June 5	80.5	78.2	83.8	84.5	80.8	---

Table 67. Mean percentage of weak plants calculated on the basis of emerged seedlings in corn seed treatment tests conducted in Illinois.

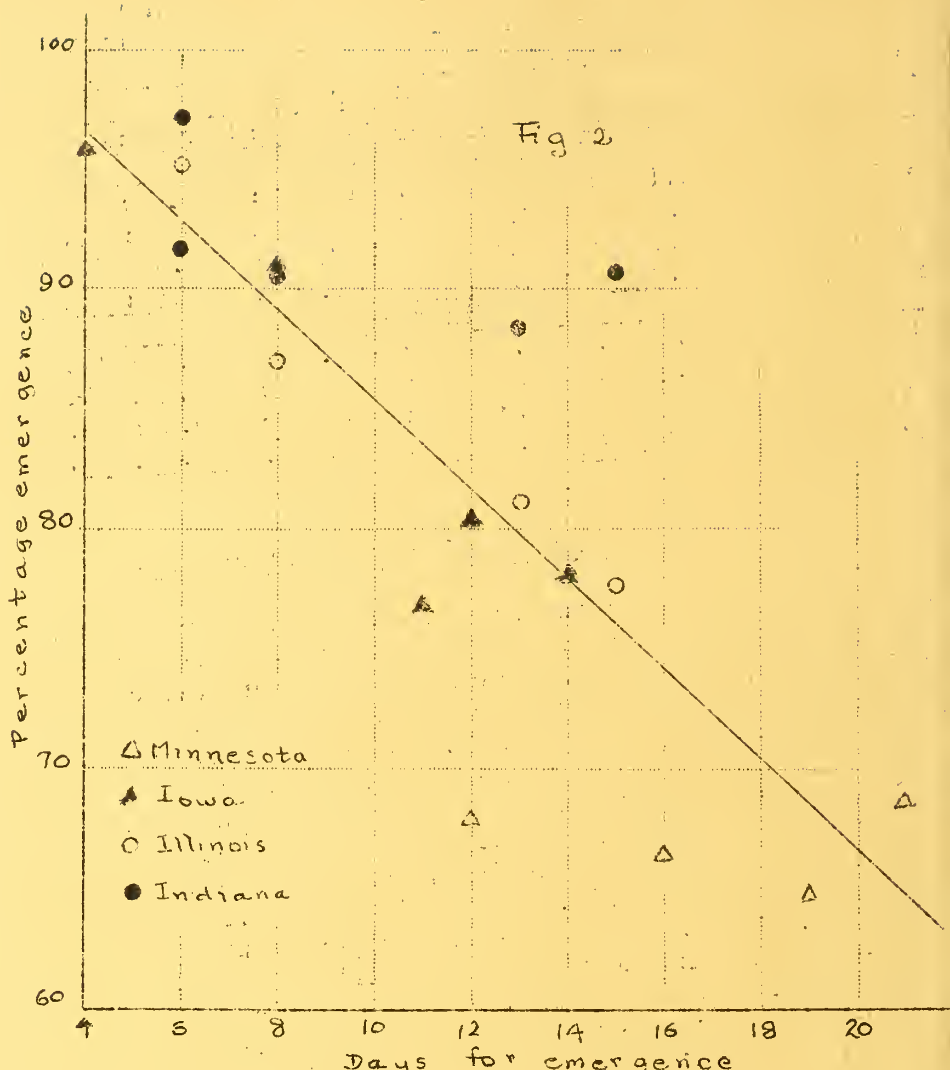
Date of planting	Seed treatment: Nontreated	Semesan Jr.	Barbak D	Spergon	Arasan	Diff. for signif.-5%
			Illinois Hybrid 960			
April 21	15.1	11.6	13.3	10.7	8.3	4.40
May 3	8.4	8.0	9.5	5.3	7.1	---
May 22	9.0	11.5	8.3	9.8	10.2	---
June 5	7.8	6.5	4.8	6.5	5.6	---
			Mixed Hybrids			
April 21	18.1	17.0	15.6	8.1	12.9	5.62
May 3	7.3	6.7	8.0	9.4	7.0	---
May 22	13.1	10.3	10.4	9.6	14.8	---
June 5	8.6	7.3	6.6	9.6	6.6	---

Summary and Discussion of Results

Some of the soil and climatic conditions surrounding each test at each of the stations are shown in Table 55, while the results of the tests are presented in the accompanying Tables. Cold wet soil conditions prevailed throughout much of the normal corn-planting period in this region except in South Dakota where the conditions were cold and dry until the latter part of May and the first of June. Significant benefits in emergence from seed treatment (Tables 56 and 57) were obtained at all April and May plantings made in Minnesota and Iowa, in 2 plantings made in Wisconsin, in 2 late April-early May plantings made in Illinois and Indiana, and in the late April planting made in Ohio. Prevailing low soil temperatures of approximately 55°F. maximum during the spring period with accompanying wet conditions appeared coincidental with significant benefits in emergence from seed treatment. Figures 1 and 2 show the general relationship of the time taken for the corn to emerge and (1) the prevailing temperatures, and (2) the percentage of emergence, respectively.

A comparison of the relative efficiency of the different fungicides in increasing emergence points to a varying effectiveness of the fungicides with the different locations and to a minor extent with the 2 varieties (Tables 58 and 59). Barbak D generally proved inferior to one or more of the other 3 fungicides at all locations at the different planting dates, more so on Illinois hybrid 960 than on the mixed hybrids, despite the benefits in emergence resulting from its use. In Minnesota, of the 4 fungicides Arasan proved significantly better than any of the other seed treatment dusts, with Semesan Jr. being next in effectiveness, followed by Spergon. In Missouri, Spergon proved significantly superior to the other 3 fungicides. In Iowa, Arasan, Spergon, and Semesan Jr. benefited emergence to a similar extent with a slight advantage going to Arasan in the case of Illinois hybrid 960, and equally to Spergon and Semesan Jr. in the case of the mixed hybrids. In Wisconsin, Semesan Jr. and Arasan appeared a little more effective on both hybrids than either Spergon or Barbak D. In Illinois, Indiana, and Ohio (April 26 planting) Spergon and Arasan seed treatment proved to be of the greater benefit to emergence.

Figure 2.
Regression of percentage emergence of Illinois hybrid 960 over 4 locations on the days required for emergence



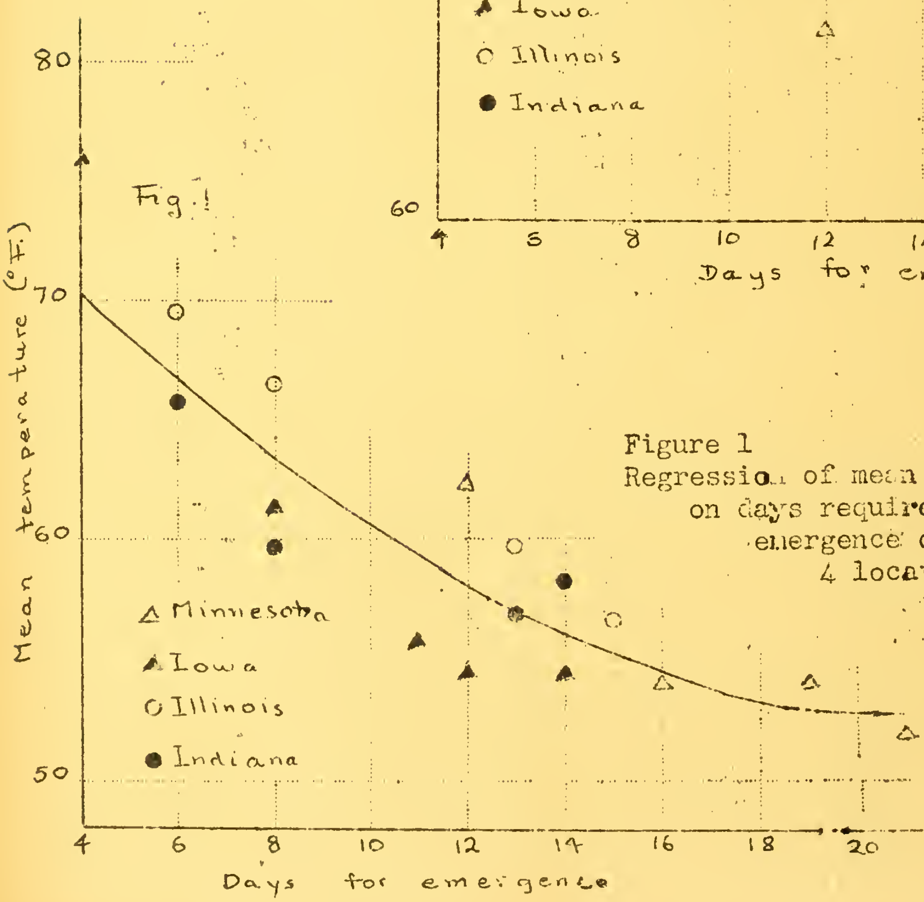


Figure 1
Regression of mean temperature on days required for the emergence of corn over 4 locations.

The apparent injury from Arasan in the Ohio May-June plantings remains unexplained.

The incidence of mesocotyl and primary root necrosis on seedlings developed from treated and non-treated seed planted at different dates was determined in the Iowa tests. The plants were dug when approximately 2 to 2-1/2 feet high, washed, and the extent of mesocotyl and primary root necrosis rated independently for each of 50 plants per treatment row, in all 300 treatment rows for the 5 dates of planting. The plants from the first 4 planting dates were examined in mid-June, when they were rapidly approaching about the same stage in development. The weather throughout May was predominantly cold, wet, and cloudy, followed by warmer, sunshiny, but still wet weather the last few days in May and the first half of June. The plants examined on July 14 for the last planting made June 19 had developed under warmer temperatures but less than optimum soil moisture conditions. The incidence of disease on seedlings was progressively greater with each successively later date of planting made (Tables 60 and 61) despite the longer growing period to which plants of the earlier planting were subjected. Greater incidence of disease occurred on the mixed hybrids than on Illinois hybrid 960. Benefits from seed treatment in the reduction of mesocotyl necrosis were noted at all planting dates, though not all of these benefits were significant. Benefits to primary root necrosis were less frequent, occurring for the most part in the 2 earliest plantings. Semesan Jr. proved superior to the other 3 fungicides in reducing mesocotyl necrosis while Spergon and Arasan were next in effectiveness and Barbak-D was generally the least effective. Reductions in primary root necrosis appeared significant with Semesan Jr. in several instances. Similar data on root necrosis for the Ohio tests (Table 62) revealed distinct benefits from seed treatment but without any consistent advantage of one or more treatments over the others. No differences in mesocotyl necrosis between Semesan Jr.-treated and non-treated seed were noted in South Dakota.

Total seedling green weight determinations per treatment row in Missouri (Table 63) and Ohio (Table 65) revealed some significantly greater green weights due to seed treatment with Spergon, Arasan, and Semesan Jr. at several dates of planting. On the weight per plant basis in Missouri, significant increases in weight were obtained only with Arasan on Illinois hybrid 960 in the planting of April 28 (Table 64).

At several planting dates in Illinois seed treatment produced significantly higher percentages of strong plants (Table 66), the percentages being based on the number of planted seeds. Levels of significance were reached in only the first planting with Spergon and Arasan when such percentages were computed on the basis of emerged seedlings (Table 67).

Isolations from necrotic primary roots in Ohio revealed a species of _Gibberella_ affecting many of these roots. In South Dakota isolations made from 8 infected mesocotyls on July 5 from plants in the June 3 planting yielded _Fusarium_ from 5 mesocotyls, _Pythium_ sp., _P. debaryanum_, and no organism from the remaining 3 mesocotyls. The Iowa isolations from necrotic mesocotyls from the first, third-fourth, and fifth dates of planting (Table 68) yielded predominantly _Fusarium moniliforme_ alone or

Table 68. Summary of Iowa isolations of fungi from necrotic corn mesocotyls

Date of planting	Number of mesocotyls examined	Number of mesocotyls yielding: Fusarium moniliforme	F. moniliforme + Trichoderma	F. moniliforme + chlamydospore fungus	F. moniliforme + chlamydospore fungus + Trichoderma	Trichoderma	Mucor
April 22	5	2	1	0	0	2	0
May 13-22	7	1	2	1	2	0	1
June 19	10	5	2	2	0	1	0

Table 69. Summary of fungi isolated from necrotic primary roots of corn in the Iowa test.

Date of planting	Number examined: Plants	Roots	Number of roots yielding: Helminthosporium	Fusarium moniliforme	Chlamydospore fungus	Rhizoctonia	Pythium	Diplodia zeae	Penicillium	Mucor	Trichoderma
April 22	12	17	13	9	3	2	3	1	0	0	0
May 13-22	15	40	33	27	40	0	1	0	0	0	2
June 19	13	20	14	15	6	0	0	0	2	1	3

Table 70. Frequency of association of fungi isolated from the same primary root portions in the Iowa tests.

Date of planting	Number examined: Plants	Roots	Helminthosporium	Fusarium moniliforme	Chlamydospore fungus	Helminthosporium + Fusarium	Helminthosporium + Chlamydospore fungus	Fusarium + Chlamydospore fungus	Helminthosporium + Fusarium + Chlamydospore fungus
April 22	12	17	1	2	0	4	1	0	2
May 13-22	15	40	1	0	3	7	6	6	19
June 19	13	20	4	5	0	4	2	0	2

together with *Trichoderma*, and/or an unidentified chlamydospore-producing organism found abundantly on the roots. A few mesocotyl tissues yielded only *Trichoderma* or *Mucor* sp., while one mesocotyl yielded *Gibberella* sp. Necrotic primary roots from the first and last dates-of-planting plots yielded predominantly *Helminthosporium* sp. and *Fusarium moniliforme*, while those from the third-fourth dates-of-planting plots yielded to the greatest extent an unidentified chlamydospore-producing organism, followed by *Helminthosporium* sp. and *Fusarium moniliforme* (Table 69). All 3 fungi were found most frequently in association with one another, with *Helminthosporium* sp. dominating the association (Table 70). The chlamydospore-producing organism was much more abundant on plants from corn planted on the third-fourth dates than on either the first or last dates. *Pythium* and *Rhizoctonia* were isolated mainly from the earlier planted corn. *Diplodia zeae* was isolated from the primary root of one plant in the early-planted corn.

IOWA AGRICULTURAL EXPERIMENT STATION, AMES

XV. 1943 RESULTS OF UNIFORM SEED TREATMENT TESTS ON SOYBEANS

Benjamin Koehler

The uniform seed treatment test on oil type soybeans was conducted in 9 North Central States in 1943. These tests were directed by the War Emergency Committee of the Upper Mississippi Valley Plant Pathologists. All the seed was treated and sent out to the cooperators from the U. S. Regional Soybean Laboratory at Urbana, Illinois. Seed of low viability was used and the planting rate was about 1 bushel of seed per acre. In the northern section (South Dakota, Minnesota, and Wisconsin) a Manchu-type soybean (72% germination) was used while in the rest of the area the Lincoln variety (47% germination) was used.

In order to study the effect of seed treatment on the effectiveness of inoculation with nodule bacteria, the plots were split, each whole plot consisting of 2 18-foot rows with the same chemical treatment, 1 row inoculated just before planting and 1 row left uninoculated. Each cooperator was furnished with a humus culture of soybean nodule bacteria with instructions to insure uniform inoculation at the different locations. Four randomized blocks were planted at each location. Since the treatment by inoculation interaction this year was not significant the estimates of stand and yield given in the Tables are the average of 8 replications.

Data were taken on both stand and yield. The seed treatment chemicals and rates of application per bushel were as follows: Untreated check, Semesan Jr. 2 oz., Fermate 1 oz., New Improved Ceresan 1/2 oz., Arasan 1 oz., Arasan 2 oz., Spergon 2 oz., and Spergon 3 oz.

Table 71 gives the names of the cooperators, locations, and general effects of the seed treatments at the various locations.

Table 71. Cooperators, locations, and general results of soybean seed treatments, 1943

Location	Cooperator's Name	Planting date	Significant effect of chemical treatment on stand	Significant effect of chemical treatment on yield
Brookings, S.D.	W.F.Buchholtz	June 18	None	Increase
Lincoln, Nebr.	J.E.Livingston	May 28	Increase	None
Manhattan, Kans.	J.W.Zahnley E.D.Hansing	May 29	None	None
Columbia, Mo.	C.M.Tucker	June 28	None	None
Ames, Iowa	G.C.Kent	May 28	Increase	Decrease
St. Paul, Minn.	I.W.Tervet	June 5	Increase	(a)
Urbana, Ill.	W.B.Allington	May 31	Increase	None
Madison, Wis.	J.G.Dickson	May 27	None	(a)
Columbus, Ohio	L.C.Saboe	June4	Increase	None

(a) Not harvested

Effect of Soybean Seed Treatment on Stands

Significant increases in stand from seed treatment were obtained in Minnesota, Ohio, Illinois, Iowa, and Nebraska, whereas the increases were not statistically significant in Wisconsin, South Dakota, Kansas, and Missouri. For all the stations together every treatment used was significantly better than the check as shown in Tables 72 and 73. The heavy

Table 72. Effect of various chemical seed treatments on the stand of Lincoln soybeans at 6 central locations in 1943

Treatment Chemical	Oz/ Bu	Urbana Illinois	Columbus Ohio	Columbia Missouri	Ames Iowa	Lincoln Nebraska	Manhattan Kansas	Mean
		Average number plants per row[a]						
Check		69	56	76	88	83	99	79
Semesan Jr.	2	89**	66*	75	95*	89	103	86**
Fermate	1	86**	73**	83	99**	93*	107	90**
New Improved Ceresan	1/2	85**	74**	78	93	100**	103	89**
Arasan	1	88**	73**	78	91	93*	106	88**
Arasan	2	93**	80**	83	101**	96**	107	93**
Spergon	2	82**	66*	83	92	90	106	87**
Spergon	3	90**	74**	84	90	89	105	89**
MSD (1%)		8	12	--	10	12	---	6
(5%)		6	9		7	9		4

[a]181 seeds planted per 18 ft. row
*Significant over the check
**Highly significant over the check

Table 73. Effect of various seed treatments on the stand of Manchu soybeans at 3 northern locations in 1943.

Treatment Chemical	Oz/ Bu	Madison Wisconsin	St.Paul Minnesota	Brookings South Dakota	General mean
		Average number plants per row[a]			
Check		75	38	40	51
Semesan Jr.	2	81	42	49	57*
Fermate	1	87	39	49	58*
New Improved Ceresan	1/2	82	40	53	58*
Arasan	1	85	42	51	59**
Arasan	2	80	44	54	59**
Spergon	2	83	45	53	60**
Spergon	3	84	56**	55	65**
MSD (1%)		--	14	--	8
MSD (5%)		--	10	--	6

[a]118 seeds planted per 18-ft. row
*Significant over the check
**Highly significant over the check

application of Arasan appeared to be the best treatment this year. The treatment x station and the inoculation x treatment interactions were not statistically significant. Very little is known concerning the causal factors for seed decay, seedling diseases, etc., with soybeans, consequently nothing was learned in regard to control of specific diseases of that nature. Most of the plantings were made later than the normal time due to unfavorable weather conditions. Fairly accurate records were kept of the environmental conditions from the time of planting until the final stand counts were taken. The effectiveness of the seed treatments apparently did not depend upon any one environmental factor.

Effect of Soybean Seed Treatment on the Yield

Somewhat better yields were obtained from treated seed than from untreated seed in South Dakota, Kansas, Illinois, and Ohio, but only in South Dakota were the increases significant as shown in Table 74. No increases were obtained in Missouri, Iowa, and Nebraska. Yields were not obtained at St. Paul, Minnesota, and at Madison, Wisconsin.

Table 74. The effect of seed treatment on the yield of Lincoln soybeans at 6 locations and Manchu soybeans at 1 location in 1943

Treatment	Oz/Bu	Yield (grams per 16 ft. row)[a] Brookings S.D.	Urbana Ill.	Columbus Ohio	Columbia Mo.	Ames Iowa	Lincoln Nebr.	Manhattan Kans.	Mean of 6[b] locations
Check		221	730	780	430	1244	902	708	799
Semesan Jr.	2	271	730	872	394	1205	848	755	801
Fermate	1	297*	733	843	412	1169	888	769	802
New Improved Ceresan	1/2	315*	760	842	404	1177	834	712	788
Arasan	1	304*	779	858	427	1140	908	777	815
Arasan	2	315*	775	850	434	1220	903	758	823
Spergon	2	313*	768	898	428	1053	878	737	794
Spergon	3	337**	773	855	390	1231	836	773	810
MSD (1%)		98							
(5%)		72							

*Significant over the check
**Highly significant over the check
[a]Manchu variety at Brookings, S.D., Lincoln variety at other locations
[b]Data from Brookings excluded

Although in many cases attempts were made to locate the plots where soybeans had never been grown before in order to test adequately the effect of seed treatment upon the effectiveness of inoculation, only one station met with apparent success. At Brookings, South Dakota, the uninoculated rows were entirely free of nodules, while nodulation occurred in the inoculated rows. Careful examination of roots at this station disclosed

that all the seed treatments were detrimental but not prohibitive to nodulation. The most interesting result in regard to inoculation, however, is that with the exception of Urbana, Illinois, all the locations reported decreased yields with inoculation. This was true of the checks as well as of the chemical treatments. The reason for this unexpected result is obscure. No effect on stands was found but some of the yields were reduced significantly and the general reduction in yield at all locations was highly significant (Table 75).

Table 75. Effect of inoculation in uniform seed treatment experiment on yield of soybeans in 1943.

	Mean yield[a]		
Location	Inoculated	Uninoculated	MSD
Urbana, Illinois	768	743	
Columbus, Ohio	845	855	
Columbia, Missouri	393	435**	33
Ames, Iowa	1158	1201	
Lincoln, Nebraska	866	882	
Manhattan, Kansas	736	760*	19
Brookings, South Dakota	287	305	
Mean	794	813**	16

*Significant over the check
**Highly significant over the check
[a]Grams per 16 ft. row

At the locations where the plants from uninoculated seed were well nodulated, treatments with the seed disinfectants used had no noticeable retarding effect on nodulation.

The common farm practice at present is to plant more soybean seed per acre than is absolutely necessary in order to have added assurance of good stands. The result from seed treatment tests this year indicate that the rate of seeding might possibly be reduced about 10 percent without a reduction in stand if the seed is treated.

These tests must be conducted for several more years before definite conclusions can be reached. At present seed treatment for soybeans cannot be recommended.

(Soybean Seed Treatment Committee

W. B. Allington, U.S. Regional Soybean Laboratory
G. C. Kent, Iowa Agricultural Experiment Station
I. W. Tervet, Minnesota Agricultural Experiment Station
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XVI. THE PRE-TREATMENT OF SEED BEFORE DISTRIBUTION TO GROWERS

George L. McNew

Should vegetable and other seed be treated by the seedsmen before it is distributed to the growers? If so, what seed should be treated, what problems will this present to the seedsmen and what can plant pathologists do to assist the seedsmen in overcoming these difficulties?

A. Introduction

During the past 25 years considerable information has been secured on the value of seed treatments. Most competent authorities now agree that treatment is quite essential to the production of certain crops, in some cases to prevent transmission of disease agents, in others to protect the seed from soil-inhabiting disease organisms.

There are very few agricultural practices that pay such large dividends for such a modest investment as that required for seed treatment. The cost of treatment for an acre of sweet corn is only 3 cents; lima beans, 10 cents; spinach, 25 cents; and peas, 67 cents. Such treatments are wise investments because they serve as insurance against stand failure that may cost as much as $20 an acre in refitting and reseeding, to say nothing of reseeding at a less favorable planting date. Yield increases in many areas may give returns of $2 to $40 an acre. There are a few localities in the United States where authorities have not yet fully determined whether seed treatment is essential; but, forthe most part, the practice is being urged throughout the country. The need for seed treatment is so universally recognized that it does not enter into this discussion.

The question immediately confronting plant pathologists is how to secure the most effective use of seed treatments. For over 20 years plant pathologists have been busy educating grower groups. In many areas they have made excellent progress particularly with large commercial growers and well-organized groups such as canners. For the most part, however, the accomplishment with small growers has been unsatisfactory. The failure has come from 4 sources:

(1) The difficulty of treating small lots of seed properly in the home (many growers still use the wrong dosage, improper chemical, and secure inadequate coverage).
(2) Confusion arising from the necessity of recommending different chemicals for different crops (the layman is slow to grasp such basic facts as the toxicity of copper to cabbage seed when the same material is ideal for spinach.
(3) The inherent negligence and carelessness of human beings in disposing of small details, and
(4) Failure of fungicide manufacturers to make materials easily accessible to all communities.

Probably nothing is more discouraging to the plant disease specialists than the difficulty the growers encounter in obtaining the necessary

chemicals. In many areas, today, plant pathologists are shaping their recommendations according to the chemicals available in rural communities rather than according to their fungicidal value. The fungicide distributors are confronted with a very difficult and expensive problem in adequately supplying the "small-package" trade. In spite of the high prices charged, it is not the most satisfactory solution to retailing. In times of national emergency such as this there is a question whether such inefficient distribution can survive. It is doubtful whether the nation can afford to provide the necessary small containers, extra labor for packaging and distributing, and large inventories of chemicals required to stock the shelves in every community.

In spite of the progress made with grower groups, it may be well to seek a more direct approach to the problem of treating seed. At the suggestion of Dr. I. E. Melhus, Chairman of the Upper Mississippi Valley group of the War Emergency Council, studies were begun in 1942 as a part of the vegetable seed treatment program for the American Phytopathological Society. Dr. R. H. Porter of Iowa and Dr. W. D. Crosier of New York established contact with the seed trade and with official seed analysts, and the writer approached the plant pathologists throughout the United States. These activities were incorporated into the program of the War Emergency Council's sub-committee on fungicides under the chairmanship of Dr. J. G. Horsfall during 1943. It is the purpose of this report to review the facts obtained to date on the possibilities of encouraging seedsmen to pre-treat vegetable seed before it is distributed.

B. Problems Involved in Inaugurating a Program of Pre-Treating Seed

There are many obvious advantages in having the seed treated at the warehouse before it is distributed to the growers. Some of these are as follows:

1. Assures more general use of seed treatments.
2. Assures proper use of chemicals and will avoid waste by carelessness, excessive dosages, and misuse. It will be much easier for us to advise a relatively few alert, well-organized seedsmen than to control the activities of every gardener and farmer. Furthermore, it is possible to use the exact minimum concentrations on large, bulk treatments in a fashion never to be obtained on small packets by the grower.
3. Promotes economy and efficiency in distributing fungicides.
    a. Manufacturers of fungicides can sell wholesale directly to a few customers.
    b. Eliminate salesmen and retailers and thereby release labor for other war efforts.
    c. Eliminate inventories of chemicals on retailers' shelves and thereby release a large supply for immediate use. This benefit alone would do as much to increase the available supplies of chemicals as any other change we could suggest in use of chemicals.

d. Eliminate much of the demand for small containers to hold quarter-pound to five-pound lots of chemicals. Containers are critically scarce and could be released for other uses.
e. Eliminates the labor and machinery used in packaging small samples of chemicals.
f. Would promote efficient distribution of chemicals direct from central warehouses to the people who use them. This would keep available supplies mobile so they could be shifted to the locality where needed, and would permit greater control and planning over manufacture and use of fungicides.

4. Eliminates the possibility of buying a pound of chemical to treat a few ounces of seed. The excess is either discarded or often left around the house or barn where it is a hazard to children and livestock

There are also many disadvantages to be overcome if such a program is to be inaugurated at present. Some of the arguments frequently advanced against such a program have been as follows:

1. Supplies of seed-treatment chemicals are inadequate. (Partially true but could be overcome by more efficient methods).
2. It would be difficult to secure the necessary additional labor for treating the seed. (A sound argument).
3. Impossible to provide necessary new equipment. (Could be improvised).
4. Unsold stocks at end of year could not be used for food, or as livestock feed. (True)
5. Treated seed lose vitality upon storage more rapidly than untreated seed. (A misconception so far as most safe fungicides are concerned.
6. Seed treatments deteriorate upon storage of seed, therefore they could not be applied well in advance of the planting season. (This applies to very few fungicides).
7. There are no treatments universally adapted to all climates and all soil types.
8. The scientific experts cannot agree on a uniform set of recommendations; therefore the seed dealer cannot be assured of their support if he treats his seed.
9. The public does not demand treated seed; therefore there is no sales advantage to the companies who go to the expense of treating.
10. In some localities, there will be active sales resistance to purchase of packages marked with "poison" signs and a warning about use of treated seed. (Probably an authentic argument but can be overcome by education)
11. The average gardener regularly plants an excessive number of seeds and thins to stand, therefore no particular damage is done by a 15 to 60% stand loss. (The obvious answer to this is that he overplants because he has come to expect stand failures a fair percentage of the time. Accurate seeding rates can never be recommended until the extreme losses during unfavorable weather periods are prevented by treatment)
12. Treated seed cannot be distributed through the mails.

13. The seed treatments are poisonous and present a health hazard to workers in seedhouses and to growers. (True, but few materials that are fairly safe can be used on many crops).

These and similar arguments must be answered completely if we are to secure the support of the seedsmen in this program. Most of the technical arguments arise from misconceptions and inadequate information as to the nature and value of treatments. These can be answered quite easily.

Other arguments such as those in 8, 9, and 10 are not fully authentic but contain enough truth to emphasize the plant pathologists' failure in presenting their case to the public.

The seedsmen have a right to demand that the plant pathologists define their position more clearly before making any nation-wide recommendations for seed treatment. In order to do this, a careful survey was made of the plant pathologists throughout the United States to determine (1) their attitude regarding the need of pre-treatment, (2) the extent to which they would endorse a uniform set of recommendations, and (3) the recommendations (as of May 1943) in vogue in different States. These reports are summarized briefly in the following 3 sections.

C. To What Extent Will the Plant Disease Specialists Support Seedsmen Who Pre-Treat Seed?

In order to determine whether the people who make recommendations to the growers throughout the United States would support a program of treating seed a questionnaire was sent to interested research and extension authorities in each State. The following questions were asked of these specialists:

A. Do you believe pre-treatment of vegetable seed desirable?
B. Do you believe pre-treatment of cereal seed desirable?
C. Do you believe pre-treatment of corn seed desirable?
D. Do you believe pre-treatment of cotton seed desirable?
E. Do you believe pre-treatment of flax seed desirable?
F. Will you support a program of pre-treating vegetable seed to the extent of giving it effective publicity in your State, by providing press releases for newspapers, delivering radio talks, discussions before garden clubs and other groups, or by special means such as bulletins and extension news?
G. Would you be willing to educate the victory gardeners of your State as to the benefits from buying treated seed by working directly with their councils?

Answers were received from the following 47 specialists throughout the United States:

1. Arizona	J. G. Brown
2. Arkansas	V. H. Young
3. California	L. D. Leach
4. California	W. C. Snyder
55. Connecticut	J. G. Horsfall
6. Florida	W. B. Tisdale
7. Illinois	M. B. Linn
8. Indiana	R. W. Samson
9. Indiana	Charles Gregory
10. Iowa	R. H. Porter and I. E. Melhus
11. Kansas	Botany Dept. (L. E. Melchers)
12. Kentucky	W. D. Valleau
13. Maine	Donald Folsom
14. Maryland	C. E. Cox
15. Massachusetts	O. C. Boyd
16. Massachusetts	E. F. Guba
17. Minnesota	C. J. Eide
18. Mississippi	J. A. Pinckard
19. Missouri	C. M. Tucker
20. Montana	H. E. Morris
21. New Hampshire	M. C. Richards
22. New Jersey	C. M. Haenseler
23. New York	Charles Chupp
24. New York	George L. McNew
25. New York	Willard Crosier
26. North Carolina	H. R. Garriss and D. E. Ellis
27. North Dakota	W. E. Brentzel and F. G. Butcher
28. Ohio	C. C. Allison
29. Ohio	J. D. Wilson
30. Oklahoma	K. S. Chester and J. H. McLaughlin
31. Oregon	F. P. McWhorter
32. Pennsylvania	R. S. Kirby
33. Rhode Island	F. L. Howard
34. Tennessee	C. D. Sherbakoff
35. South Carolina	W. C. Nettles
36. South Carolina	C. J. Nusbaum
37. South Carolina	C. N. Clayton
38. South Dakota	W. F. Buchholtz
39. Vermont	C. H. Blasburg
40. Virginia	R. P. Porter
41. Virginia	E. K. Vaughan
42. Washington	C. J. Gould
43. West Virginia	J. G. Leach
44. Wisconsin	J. C. Walker and R. E. Vaughan
45. U. S. Dept. Agr. (Extension Service)	R. J. Haskell
46. U. S. Dept. Agr. (Bureau of Plant Industry Station, Maryland)	S. P. Doolittle
47. U. S. Dept. Agr. (at Georgia Coastal Plain Experiment Station)	W. D. Moore

The answers of these men are summarized in Table 76:

Table 76. Opinion of plant pathologists in different States regarding pre-treatment of different seeds.

Report from:	Opinion regarding different questions						
	Is pre-treatment desirable?					Amount of publicity[a]	Inform victory gardeners
	Vegetable	Cereal	Corn	Cotton	Flax		
Question	(A)	(B)	(C)	(D)	(E)	(F)	(G)
1. Ariz.	Yes	Some	No	No	--	P R T A	Yes
2. Ark.	Yes	Yes	No	Yes	--	P R T A	Yes
3. Calif.	Yes	No	No	No	No	- - T -	Yes
4. Calif.	Yes	--	--	--	--	- - - -	No
5. Conn.	Yes	Yes	No	--	--	P - T -	Yes[b]
6. Fla.	Yes	--	Yes	Yes	--	P R T -	Yes
7. Ill.	Yes	--	--	--	--	P R T A	Yes[b]
8. Ind.	Yes	--	--	--	--	- - - A	Yes
9. Ind.	Yes	No	No	--	--	P R T -	Yes
10. Iowa	Yes	Yes	Yes	Yes	Yes	P R T A	Yes[b]
11. Kans.	Yes	Yes	Yes	--	Yes	P R T A	Yes[b]
12. Ky.	Yes	Yes	Yes	--	--	P - - A	Yes[b]
13. Me.[c]	--	--	--	--	--	- - - -	--
14. Md.	Yes	Yes	Yes	--	--	P - T A	Yes[b]
15. Mass.	Yes	Yes	Yes	--	--	P R T A	Yes
16. Mass.	Yes	Yes	Yes	--	--	P R T A	Yes
17. Minn.	Yes	Yes	Yes	--	Yes	P R T -	Yes[b]
18. Miss.	Yes	Yes	Yes	Yes	Yes	P R T A	Yes
19. Mo.	Yes	Yes	Yes	Yes	--	P R T A	Yes
20. Mont.	Yes	No	No	--	No	P - T A	Yes
21. N.H.	Yes	Yes	Yes	Yes	Yes	P R T A	Yes
22. N.J.	Yes	Yes	Yes	--	--	P R T A	Yes[b]
23. N.Y.	Yes	Yes	--	--	--	P R T A	Yes[b]
24. N.Y.	Yes	Yes	Yes	--	--	P R T A	Yes
25. N.Y.	Yes	--	--	--	--	P R T A	Yes
26. N.C.	Yes	--	--	--	--	P R T A	Yes
27. N.D.	Yes	Yes	Yes	--	Yes	P R T A	Yes
28. Ohio	Yes	No	Yes	--	--	P R T A	Yes
29. Ohio	Yes	Yes	No	--	--	P R T -	Yes
30. Okla.	Yes	Yes	--	Yes	--	P - - -	--
31. Oreg.	Yes	--	--	--	--	- - T -	Yes
32 Pa.	Yes	Yes	Yes	--	--	P R T A	Yes
33. R.I.	Yes	--	--	--	--	P R T A	Yes
34 Tenn.	Yes	Yes	--	Yes	--	- - - -	Yes[b]
35. S.C.	--	--	--	--	--	- - - -	--
36. S.C.	Yes	--	--	--	--	P - T -	--
37. S.C.	Yes	--	--	--	--	- R T -	--
38. S.D.	Yes	--	Yes	--	Yes	P R T A	Yes
39. Vt.	Yes	Yes	--	--	--	P - T A	Yes
40. Va.	Yes	--	--	--	--	- - - A	Yes[b]

(Table concluded on following page)

Table 76 (concluded)

Report from:	Opinion regarding different questions						
	Is pre-treatment desirable?					Amount of publicity	Inform victory gardeners
	Vegetable	Cereal	Corn	Cotton	Flax		
Question	(A)	(B)	(C)	(D)	(E)	(F)	(G)
41. Va.	Yes	Yes	Yes	Yes	--	P - T A	Yes
42. Wash.	Yes	Yes	--	--	--	- R T -	Yes[b]
43. W.Va.	Yes	Yes	Yes	--	--	P R T A	Yes
44. Wis.	Yes	Yes	Yes	--	Yes	P R T A	Yes
45. USDA	Yes	Yes	Yes	Yes	Yes	P R T A	Yes
46. USDA	Yes	--	--	--	--	- - - - -	Yes
47. USDA	Yes	--	--	--	--	- - T A	Yes

a Amount of publicity: P -- prepare press releases; R -- deliver radio talks; T -- personal appearance before grower groups; A -- write articles for extension release, bulletins, and journals.
b Would delegate authority to a colleague within the State.
c Data for State on seed treatments not yet completed

An examination of the tabulated information shows unanimous agreement on the need of seed treatment for most of the crops with which these workers are familiar. They believe emphatically that the seedsmen would be performing a commendable public service by treating seed before it is packaged. They are willing to support the seedsmen who participate by publicizing the merits of treated seed. Most of them would even go so far as securing petitions for pre-treated seed from victory gardeners to reassure seedsmen if the latter required additional evidence of their support and also of the practical advantages of supplying treated seed to the home gardener.

From miscellaneous comments returned with the questionnaire it is obvious that very few, if any, of the State authorities wish to high-pressure the seed producers and retailers into treating seed against their will. The unanimous sentiment seems to be that plant pathologists should assist, cooperate with, and advise all seedsmen, and assure them of active support for those who find it possible to treat seed for their customers. Most pathologists feel that under the terms of such a cooperative effort, a program of pre-treating all packet vegetable seed will flourish and eventually become a standard practice among seedsmen.

D. A Set of Standard Recommendations for 1944

The cooperative seed treatment tests of 1940, 1941, and 1942 had provided abundant sound data; therefore it was possible to pick out certain treatments for various vegetables that seemed universally effective. On the basis of this information the workers listed in the preceding section were asked for their opinions regarding the following recommendations for their states:

Lima beans treated with Spergon at .201% by weight (2 oz. per bu.)
Beets with cuprous oxide at 1.5% by weight.
Sweet corn with Semesan Jr. at .17% (1.5 oz. per bu.)
Peas with Spergon at .17% (1.5 oz. per bu.)
Spinach with either zinc oxide or cuprous oxide at 1.5%

The replies to these suggestions have been condensed in Table 77:

Table 77. Opinion of cooperators in different States regarding the proposed uniform seed treatment recommendations.

Report from:	Acceptance of proposed treatment				
	Lima bean	Beet	Sweet corn	Peas	Spinach
1. Ariz.	Yes	--	--	--	--
2. Ark.	Yes	--	No[a]	Yes	Yes
3. Calif.	Yes	Yes	Yes	Yes	Yes
4. Calif.	Yes	Yes	Yes	Yes	Yes
5. Conn.	Yes	Yes	Yes	Yes	Yes
6. Fla.	Yes	--	Yes	Yes	Yes
7. Ill.	Yes	Yes	Yes	Yes	Yes
8. Ind.	Yes	Yes	Yes	Yes	Yes
9. Ind.	Yes	Yes	Yes	Yes	Yes
10. Iowa	Yes	Yes	Yes	Yes	Yes
11. Kans.	Yes	Yes	Yes	Yes	Yes
12. Ky.	Yes	Yes	Yes	Yes	Yes
13. Maine	--	--	--	--	--
14. Md.	Yes	Yes	Yes	Yes	Yes
15. Mass.	Yes	Yes	Yes	Yes	Yes
16. Mass.	Yes	--	Yes	--	Yes
17. Minn.	Yes	Yes	Yes	Yes	Yes
18. Miss.	Yes	Yes	Yes	Yes	Yes
19. Mo.	Yes	Yes	No	Yes	Yes
20. Mont.	--	Yes	Yes	Yes	--
21. N.H.	Yes	Yes	Yes	Yes	Yes
22. N.J.	Yes	Yes	Yes	Yes	Yes
23. N.Y.	Yes	Yes	Yes	Yes	Yes
24. N.Y.	Yes	Yes	Yes	Yes	Yes
25. N.Y.	Yes	Yes	No	Yes	Yes
26. N.C.	Yes	Yes	Yes	Yes	Yes
27. N.D.	Yes	Yes	Yes	Yes	Yes
28. Ohio	Yes	Yes	Yes	Yes	Yes
29. Ohio	Yes	Yes	Yes	Yes	Yes
30. Okla.	Yes	Yes	--	Yes	Yes
31. Oreg.	Yes	Yes	Yes	Yes	Yes
32. Pa.	Yes	Yes	Yes	Yes	Yes
33. R.I.	--	Yes	--	--	Yes
34. Tenn.	Yes	Yes	Yes	Yes	Yes
35. S.C.	Yes	Yes	Yes	Yes	Yes

(Table concluded on next page)

Table 77 (concluded)

Report from:	Acceptance of proposed treatment				
	Lima bean	Beet	Sweet Corn	Peas	Spinach
36. S.C.	Yes	Yes	Yes	Yes	Yes
37. S.C.	Yes	Yes	Yes	Yes	Yes
38. S.D.	Yes	Yes	Yes	Yes	Yes
39. Vt.	Yes	Yes	Yes	Yes	Yes
40. Va.	--.	Yes	--	Yes	Yes
41. Va.	Yes	Yes	Yes	Yes	Yes
42. Wash.	Yes	Yes	Yes	Yes	Yes
43. W.Va.	Yes	Yes	Yes	Yes	Yes
44. Wis.	Yes	Yes	Yes	Yes	Yes
45. USDA	Yes	Yes	Yes	Yes	Yes
46. USDA	Yes	Yes	Yes	Yes	Yes
47. USDA	--	--	--	--	--

[a] Treatment all right but not needed in this State

The cooperators who responded to the questionnaire were in surprisingly close agreement with the suggestions. Although several of them expressed a desire to name alternate treatments for their States, they were practically unanimous in endorsing the suggested treatments as being highly effective for their area. This compilation should settle once and for all the question of whether plant pathologists can agree on a set of treatments. The seedsmen who deal in interstate business can rest assured that seed treated with these particular materials will be endorsed by competent authorities in the areas where they are to be sold.

The compilation in Table 77 must not be construed as the preferred treatment in all of the States. Several authorities believe other materials to be equal to these or even slightly superior for these plants for their particular localities. Furthermore, these standards may be changed from year to year as adequate experience is obtained with other treatments. Undoubtedly, there would be considerable sentiment for the use of Arasan on spinach and sweet corn in view of its excellent performance in the 1943 cooperative tests reported in other articles of this series.

E. What Treatments Are Being Recommended in Different States?

In order to secure some indication of the preferred treatments in different States, the cooperators were asked to nominate their first, second, and third choices for all vegetable crop seeds and the preferred dosages. These data have been summarized and are on file with the committee chairman.

F. Postal Regulations Affecting Shipment of Treated Seed through the Mails

Although several seed dealers have been distributing treated seed through the mails for several years, some retailers expreseed concern that they would run afoul of postal regulations if they inaugurated a program of pre-treating vegetable seed. The committee, therefore, devoted considerable study to the existing regulations and conferred with the proper au-

thorities regarding certain changes that seemed desirable. It may be worth while to summarize the results of these investigations, in order to clear up certain misconceptions prevalent among both plant pathologists and seedsmen.

The following postal regulations were found to be in effect on May 27, 1943:

1. Treated seed are admissible to the mails.
2. No specific regulations on the shipment of treated seed have been in force.
3. The rigid regulations controlling the shipment of fungicides could be invoked against seed that carried these fungicides. The Postal Laws and Regulations specify that cartons of fungicides must be marked "Poisonous Composition" and bear the manufacturer's label (Section 588, paragraph 4b). The fungicide must be enclosed in an inside container of metal, glass, or fiber, and these, in turn, must be packed inside a box with ample cushioning material to prevent breakage and in the case of liquids to absorb the fungicide should inside container be broken (Section 590, paragraph 4f).

Since it was obvious that these restrictions on packages would cause seedsmen considerable difficulty if they were applied to treated seed, the Committee conferred with Mr. J. D. Hardy, General Superintendent of the Division of Railway Mail Service, Post Office Department, regarding a more practical arrangement. Mr. Hardy suggested that sealed envelopes or packets should first be placed in a cardboard box or boxes and then in a fiber mailing box before they would be acceptable for mailing. He did not consider it desirable to have the envelopes loose in the outside container.

It is obvious that even this lenient requirement would entail extra packages and labor, and would work a hardship on seedsmen. This ruling was considered unduly strict because 99.8% of the packet consists of seed and the 0.2% of fungicide is so firmly attached to the seed that there is practically no chance for it to escape into the mail and create a nuisance. After considering these extenuating circumstances, Mr. Hardy accepted our suggestion for admitting the regular packets as long as they are protected by a second covering. In a letter to the writer, dated July 27, 1943, he specified,

"Seeds treated with a fungicide will be accepted for transmission in the mails when inclosed in two strong envelopes, the inside envelope to contain the seed. In no case should the envelope bulge from too many seed inclosed."

This final ruling would appear to be very reasonable and broad-minded. It specifically exempts treated seed from the rigid rules governing shipment of fungicides in bulk. It places considerable responsibility on the seedsmen, but it will not cause them any particular difficulty since the standard packages now used by most companies will be acceptable. The seed distributors will have to take precautions to be certain that:

1. All packets and boxes have the flaps completely and firmly sealed.
2. Envelopes are not overloaded so as to create excessive internal pressure.
3. Single envelopes or packets are enclosed in a strong envelope before mailing.
4. Orders involving several packets are enclosed in strong envelopes or preferably in strong cardboard or fiber boxes that will prevent crushing from external pressure.

The Committee trusts that these facts will be of interest to seed distributors and will encourage them to go ahead in treating seed that will later be transmitted through the mails. The Committee also feels that a word of commendation of the Post Office Department's cooperative attitude and very courteous handling of this matter is fully warranted.

A memorandum covering the facts outlined above, and in the same wording, was submitted to Mr. Hardy on August 4 and was approved for publication by him in a letter to the writer on August 18 (filed in their correspondence under code RyHs-H).

G. Summary of Status of Project on Pre-Treatment of Vegetable Seed

The data obtained to date and presented in this report show that there are practically no technical obstacles in the way of the program for pre-treatment of vegetable seed. There are several good treatments for each crop and most of these seem to be universally effective. It is possible to pick from among these at least one for each crop that is relatively non-toxic to human beings. The plant pathologists have agreed upon a uniform set of treatments for the principal vegetables, but details must still be worked out regarding minor crops and certain seed disinfectants. Of the standard treatments adopted to date only one (on sweet corn) is a violent poison and this material undoubtedly could be replaced safely by less toxic materials such as Arasan or Spergon.

The seedsman who deals in interstate business needs to use only one treatment on a given crop. In case he is interested in preferred treatments for any locality in the United States, he can obtain information from this committee as to whether it differs from the standards. Those seedsmen who follow these recommendations can expect reasonable support and active promotion from plant pathologists. The postal regulations have been modified so that seedsmen will not have to alter their mailing packages or go to appreciable extra distribution costs if they treat the seed before distribution.

As a matter of fact, about the only concrete arguments still standing against inaugurating the program are the mechanical difficulties involved. There is no question that the seedsmen will find it difficult at this time to secure additional equipment and labor for this added service and supplies of some chemicals will be inadequate. In spite of all this, however, at least one major seed house operating throughout the nation has inaugurated a comprehensive program and several others have indicated

an interest in inaugurating a modest program.

The plant pathologists are under an obligation to push their publicity program on seed treatments. They must educate the growers as to the value of seed treatments and the advantage of securing pre-treated seed wherever they are available. Efforts must be continued to keep the list of approved treatments up to date.

NAUGATUCK CHEMICAL DIVISION OF UNTIED STATES RUBBER COMPANY, NAUGATUCK, CONN (Formerly at New York State Agricultural Experiment Station, Geneva)

XVII. COOPERATION OF SEEDSMEN IN TREATING SEED BEFORE DISTRIBUTION

Willard Crosier and R. H. Porter

Contacts were made during 1943 with various seed trade groups in order to further the seed-treatment program. It was considered necessary for the plant pathologists to obtain information on the status of seed-treatment practices in various seed companies before offering their services or suggesting any changes. Undoubtedly any sudden expansion of seed treatments would create certain problems for seedsmen, official analysts, and related agencies; therefore, circular letters and questionnaires as well as personal contacts were employed in exchanging information.

The seedsmen expressed onsiderable interest in the project and were fully cooperative. In addition to supplying information about their trade practices, several of them submitted samples of pea, spinach, and lima bean stocks for tests. The information obtained from the seedsmen and these cooperative tests are briefly summarized in this report.

Seedsmen's Opinion Regarding Treatment of Seed Before Distribution

Questionnaires were mailed to many of the seed houses throughout the United States shortly after the authors joined the committee in March, 1943. The answers received and results of a similar survey made by the junior author in 1942 showed that the seedsmen were fully aware of the advantages of seed treatment and were treating seed for their own foundation stocks and for their customers. Many were hesitant, however, about initiating a seed treatment program because of labor and material shortages, lack of demand, and the health hazards involved. The seed treatments used were those recommended by State experiment stations and the U. S. Department of Agriculture.

Most of the seed companies gave an affirmative answer to the question "Would you be willing to treat your packeted seed if you were convinced it was of value to you?" All those replying to the questionnaire requested additional information on the subject of seed treatments, and many of them pointed out the special problems that would confront them. Typical comments were as follows:

1. "We have well recognized the value of certain seed protectants and have used them over a period of years", but . . . "there is the matter of securing sufficient quantities of seed protectants to treat even a small portion of the total amount of vegetable seeds."

2. "At present the drawbacks are <u>time</u>, danger of mixtures, and discomfort to employees in packaging."

3. "It would probably be impossible to treat all seeds sold on account of scarcity of labor and materials. For some vegetable seeds we are not sure about the proper material to use, and in these cases we simply have treated seed only on the customer's request."

Current Seed Treatment Practices

Several companies provided information on the extent to which they use seed treatments. Practically all of those who produced seed or maintained foundation stock used treated seed in their own plots. The program for treating their customers' seeds varied widely. Only one company treated all seed of the 7 vegetables specifically mentioned in the questionnaire. Several others, however, were willing to treat the seed upon request. The records on 5 companies that were kind enough to supply complete information have been summarized in Table 78.

Table 78. Types of seed treatments used by different seed companies on 7 vegetable crops.

Kind of seed treated	Protectant used by[a] I	II	III	IV	V	Extent of treating by I	II	III	IV	V
Beets	CO[b]	ZO	CO	CO	CO	[c]AC	AC	R	T	P
Cucumbers	CO	ZO	Hg	CO/Hg	--	AC	AC	R	T	--
Lima beans	Sp	--	Sp	Sp	Sp	AC	--	R	T	P
Melons	CO/Hg	ZO/Hg	Sp/Hg	CO/Hg	--	AC	AC	R	T	--
Peas	Sp	Sp	Sp	Sp	S, A	AC	AC	R	T	AC
Spinach	ZO	ZO	CO	CO,ZO	CO	AC	AC	R	T	P
Sweet corn	Sp	--	Sp, SJ	SJ	SJ	AC	--	R	T	P

[a] The seedsmen contributing to this report are: I, Eastern States Farmers' Exchange; II, Southern States Coop., Inc.; III, Associated Seed Growers, Inc.; IV, Ferry-Morse Seed Co.; and V, Robson Seed Farms.

[b] The symbols used are as follows: A, Arasan; CO, red copper oxide; Hg, mercuric chloride; S, Semesan; SJ, Semesan Jr.; Sp, Spergon; and ZO, zinc oxide.

[c] The symbols used are as follows: AC, for all customers; P for part of customers; R, upon request only; and T, for trial and foundation stocks only.

It is of interest to note that spinach and pea seed are being treated more estensively than that of the other crops. This undoubtedly is due to the greater susceptibility of these seed to decay and of the seedlings to damping-off. Most of the treatments being used are primarily seed protectants. However, in the case of melons and cucurbits, the bichloride of mercury dip is commonly used as a disinfectant prior to the application of a protectant.

Results of Trials with Typical Seedstocks

Since it has been shown that different seed stocks, even within the same variety, differ widely in their responses to seed treatment, several growers were invited to submit stock typical of those used for the packet trade. It was hoped that records would be obtained on a typical cross section of the seed being used by the trade and at the same time interest would be aroused in seed treatments among any critical seedsmen who were skeptical of its value.

Several stocks of peas, lima beans, and spinach were treated with different materials and planted in a series of tests under different conditions in New York and Iowa. The treatments applied were: to peas, Arasan at 0.12% and Spergon at 0.21%; to lima beans, Arasan at 0.12%, Spergon at 0.21%, and Fermate at 0.21%; and to spinach, Arasan at 0.5%, Spergon at 1.0%, and zinc oxide at 1.0%. The results from several tests made in New York State are summarized in Table 79. The treatments were decidedly beneficial in nearly all tests. Even the starchy-seeded Alaska variety of peas that is not very susceptible to seed decay gave substantially better emergence when treated.

Table 79. Effectiveness of seed treatments in improving the emergence of different seed stocks under New York conditions.

Variety of seed	Where planted	Emergence from seeds treated with: Check	Arasan	Spergon	Fermate
		Peas			
Thomas Laxton	Field	25	44	47	--
Thomas Laxton	Greenhouse	38	86	86	--
Alaska	Field	63	--	73	--
Little Marvel	Field	64	--	73	--
Worlds Record	Field	49	--	64	--
Wisconsin Perfection	Field	31	--	55	--
		Lima beans			
Fordhook	Field	11	15	19	9
Fordhook	Greenhouse	18	67	60	59
Henderson Bush	Field	4	--	28	--
Burpee's Bush	Field	8	--	23	--
Burpee's Large White	Field	5	--	14	--
Emerald Bush	Field	2	--	17	--
		Spinach			
Viking	Field	25	32	36	35
Viking	Greenhouse	46	62	48	56
King of Denmark	Field	11	--	--	23
L. S. Bloomsdale	Field	28	30	--	39
L. S. Bloomsdale	Greenhouse	62	71	--	67
King of Denmark	Field	10	13	--	16
King of Denmark	Greenhouse	47	55	--	54

A similar series of tests was made with some of the same seed lots under Iowa conditions. Emergence records are given in Table 80. Although better conditions prevailed for seed germination, all lots of spinach benefited from treatment and there was a slight improvement in the peas. No lima beans were tested in Iowa.

Table 80. Effect of seed treatments on emergence of seed sown under Iowa conditions.

Seed treated		Percentage of emergence			
Crop	Variety	Check	Arasan	Spergon	Zinc oxide
Peas	Thomas Laxton	87.0	94.6	8[illegible].4	---
Spinach	Viking	51.2	57.4	56.0	64.6
Spinach	L. S. Bloomsdale	54.8	69.6	---	67.6
Spinach	King of Denmark	36.8	44.0	---	44.4

Support from Special Groups

In addition to correspondence with seed companies, personal contacts were made by plant pathologists in different sections of the country. Some of the following observations further emphasize the growing interest of seedsmen in seed treatments.

Dr. L. D. Leach of Davis, California, reported on interviews held with seedsmen at the Pacific States Seedsmen's Association meeting in June 1943. He found seedsmen interested, some practicing treatment, and some feeling that a program of the kind advocated is inevitable. He recommended that our program for the first year be limited to a few crops which are quite susceptible to damping-off and that the chemicals employed should be absolutely safe to both the crop and to human beings.

Dr. A. N. Brooks of Florida was invited to speak before the Florida Seedsmen's Association and received offers of their cooperation in the program of seed treatment. Later he and Dr. W. B. Tisdale provided a mimeographed circular to assist those interested in the project.

The senior author prepared an article that was published in the Seed World. Mr. Helgoson, the editor, has indicated his whole-hearted cooperation in the project of improving the performance of seed stocks. Similar favorable publicity for pre-treatment was obtained in an article by P. W. Dempsey published in The Flower Grower

The junior author spoke before the newly organized vegetable seed producers group of the American Seed Trade Association in June 1943, and presented data on the treatment of peas, spinach, onions, and other vegetable crops obtained in a special laboratory method using Pythium-infested soil. The interest of those who attended the meeting indicated that seedsmen will cooperate in so far as they consider it safe and practical.

In order to prevent any misunderstanding with persons interested in seed analysis, Mr. C. A. Stahl, president of the Association of Official Seed Analysts, was consulted about the program for encouraging pre-treatment of packeted seed. The widespread application of fungicides might present certain problems of health to the analysts and require revisions in methods of testing viability. Mr. Stahl was of the opinion that there would be no serious objection to testing treated seed provided non-poisonous materials were used.

Postal and Labeling Regulations

Both Mr. Stahl, and Mr. W. A. Davidson, of the Grain and Feed Division, U. S. Department of Agriculture, were of the opinion that postal regulations should be sufficiently lenient to permit distribution of treated seed, and the latter cooperated with the Committee in contacting the postal authorities on the subject. The postal authorities have agreed to a simple, safe package for treated seed, as reported in the preceding article of this series.

The "rules and regulations" of the Secretary of Agriculture for the enforcement of the "Federal Seed Act of August 9, 1939" contain no mention of the labeling requirements for chemically treated seed. Likewise, the suggested "Uniform State Seed Law of June 12, 1940" does not cover the necessary labeling for treated seeds. The United States Pure Food and Drug Administration requires, however, that seed treated with poisonous materials should be labeled. Seedsmen now mark plainly all containers of treated seed with "Poison", "Treated Seeds", "Treated with Semesan", or similar designations. In order to remove the possible sales resistance to packets marked "Poison" and to protect children and small animals, it is advisable that vegetable seeds be treated with a non-poisonous material. The simple statement "Treated Seeds" would then suffice and should provide an incentive rather than an obstacle to buying.

Summary

There seem to be very few difficulties in the way of developing a general program of treating seed before distribution, aside from the difficulties seedsmen will experience in securing labor and equipment. All of the more progressive seed houses are fully aware of the benefits to be obtained from use of seed treatments. Most of them realize that even the best quality seed may be protected from disease organisms so that it will give better performance by treatment. They are perfectly willing to treat seed for their customers as soon as supplies of fungicides become available.

The years immediately ahead may be an opportune time to promote general use of seed treatments in spite of the physical obstacles to be overcome. The American seedsmen will be confronted with a serious problem in supplying the phenomenally heavy demands during 1944. The commercial pack will be 5 to 10% less than that of last year, and the demand greater. In addition to the increased domestic demand, large quantities of seed must be supplied to England and to the liberated areas of Russia, Italy, and Africa. The seedsmen are anxious to meet these unprecedented demands by making more effective use of stocks by such practices as seed treatment that would permit lighter seeding rates. The extent of domestic consumption alone is scarcely realized by the average person. For example, about 18,000,000 packets of vegetable seed were vended in New York State alone during 1943.

There seem to be no serious legal restrictions on the treatment of packet seed, and the seed analysts apparently have no objection to the seed treatment program. A serious effort should be made to develop non-poisonous treatments for use on vegetable seed. This has largely been accomplished by the discovery of the effectiveness of Spergon, Arasan, and zinc oxide.

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IOWA STATE COLLEGE OF AGRICULTURE AND MECHANIC ARTS, AMES

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SUPPLEMENT 146

METHODS OF APPRAISING INTENSITY AND DESTRUCTIVENESS OF CEREAL RUSTS WITH PARTICULAR REFERENCE TO RUSSIAN WORK ON WHEAT LEAF RUST

April 1, 1944

F O R E W O R D

Dr. Chester's summary and discussion of methods of determining the intensity of and estimating losses from cereal rusts is an extremely useful contribution to the literature on survey procedures. Much of the material included is not readily available to American workers; particularly the important Russian work which as Dr. Chester shows, is so full of practicable suggestions.

This article sets a high standard and should prove a strong impetus toward achieving the "research level of plant disease surveying", one of Dr. Chester's own objectives.

The Reporter hopes the article may be of distinct service to all plant pathologists who are interested in the effects of the diseases that they study.

METHODS OF APPRAISING INTENSITY AND DESTRUCTIVENESS OF CEREAL RUSTS WITH PARTICULAR REFERENCE TO RUSSIAN WORK ON WHEAT LEAF RUST

K. Starr Chester

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I. INTRODUCTION

The present intensification of plant disease survey activities, as pointed out at the meeting of the American Phytopathological Society in 1943, brings with it the need of improvements in the methodology of plant disease surveying. During the past quarter-century a number of Russian phytopathologists have given particular attention to means for improving the accuracy of estimating the intensity and destructiveness of plant diseases. The contributions of the Russian workers include a number of original procedures which well merit the study of American phytopathologists, but which as yet do not appear to be generally recognized. This may be largely due to the fact that the Russian work, almost without exception, has appeared in Russian journals, some of them of small circulation and little known, and without summaries in the other languages of science that are more familiar to American workers; a number of these papers have escaped the abstracting journals, and where English or German abstracts have been published, these usually have devoted themselves principally to experimental results, and have been given very inadequate information on the methodological details.

This digest of Russian contributions on survey methods has been prepared in the belief that some of them may find application under American conditions. It is limited to an analysis of techniques used in appraising the cereal rusts, a field in which Russian workers have been notably active, and refers in particular to wheat leaf rust (Puccinia triticina Erikss.), which, as it is the most destructive of the cereal rusts in Russia (19), has received special attention at the hands of pathologists in that country. Contributions from workers in other countries are mentioned only to the extent that they provide necessary background for an understanding of the Russian work.

II. METHODS FOR DETERMINING INTENSITY OF RUSTS

1. Standards of measurement. In 1892, Cobb (5) in Australia published what appears to be the first diagrammatic scale for estimating the intensity of cereal rusts. This scale is essentially the same as that in general use for cereal rust estimation in the United States, and is known variously in the literature as the "American scale", the "U. S. Department of Agriculture scale", and the "scale of Melchers and Parker." It was adopted shortly before 1917 and appears to have been first published by Melchers and Parker in 1922 (20). The U.S.D.A. scale is a duplicate of the Cobb

scale with the addition of one grade of rustiness (that indicated as "65%" on the U.S.D.A. scale). The 5 grades on the Cobb scale were designated 1, 5, 10, 20, and 50% and those on the American scale 5, 10, 25, 40, 65, and 100% respectively, the greatest rust intensity in each case being represented by an actual coverage of 37% of the leaf surface by rust pustules. Vavilov (39A, 40) in 1913 and 1919 published comparable diagrammatic scales for estimating leaf and stripe rusts, with 4 stages designated 1, 2, 3, & 4.

Other investigators have not used diagrammatic scales but have designated rust intensity by descriptive terms ("little", "much", "very much", etc.), or numerals each carrying in the mind of the user the connotation of a certain degree of rustiness. Thus Eriksson and Henning in 1896 (9) recognized 4 degrees of rust intensity, indicated by the numerals 1 to 4 and described respectively as "trace", "sparse", "moderately abundant", and "abundant"; Butler & Hayman in 1906 (4) and Yachevski in 1909 (42) used similar systems; Litvinov in 1912 (17) modified this by adding the intermediate grades 0-1, 1-2, and 3-4, but still identified them only by descriptive terms. Gassner in 1915 (11) agreeing with Nilsson-Ehle (23) who used a similar but 6-grade scale, that 4 degrees of rustiness did not give sufficient diversity, recommended a scale of 8 steps (1=minimum----3=weak----6=strong----8=exceptionally strong) and used these in combination with Roman numerals I-X representing successive stages in the development of the host plant. In Gassner's notation for example, "5 VIII" would indicate medium infection when the host plant was in the post-blossoming stage.

The method of designating degrees of rustiness by numerals and descriptive terms has been assailed by Russian phytopathologists, particularly Naumov (21) and Rusakov (27). They object to the too limited number of the grades of infection in the scales of Eriksson and Henning and Yachevski, and to the use of descriptive terms in all systems in which a standard diagrammatic scale is not used, since such terms as "weak" or "abundant" have entirely different connotations to workers in regions that differ in the amounts of rust normally present. Thus the reports of different workers are not comparable nor can one determine with approximate accuracy the amount of rust corresponding to such terms.

Likewise the diagrammatic modification of Cobb's scale that is in standard use in America has not found favor with the Russian workers. Naumov (21) considers that it is "rough", "schematic", too susceptible to errors of chance, and in ill agreement with the actual distribution of rust pustules on cereal leaves in nature; Rusakov (27) agrees with Naumov.

Another problem in estimating the intensity of rusts lies in the fact that they do not infect all attacked parts of the plant uniformly. It is the rule to find plants in which some leaves have high rust percentages, others have moderate amounts of rust, and still others have none. Without a prescribed practice to follow in appraising rust under these conditions, different workers can come to very divergent conclusions respecting the same intensity of rust. Litvinov (17) met this problem by proceeding on the assumption that the degree of infection is greater in lower than in upper leaves, each leaf being more strongly infected than those above it and more weakly than those below it. (The descriptive terms applied by Litvinov in his scale involve leaf position, e.g. "1-2"=very strong infection of 4th leaf from top; "2"-very strong infection of 3rd leaf from top, etc.). If

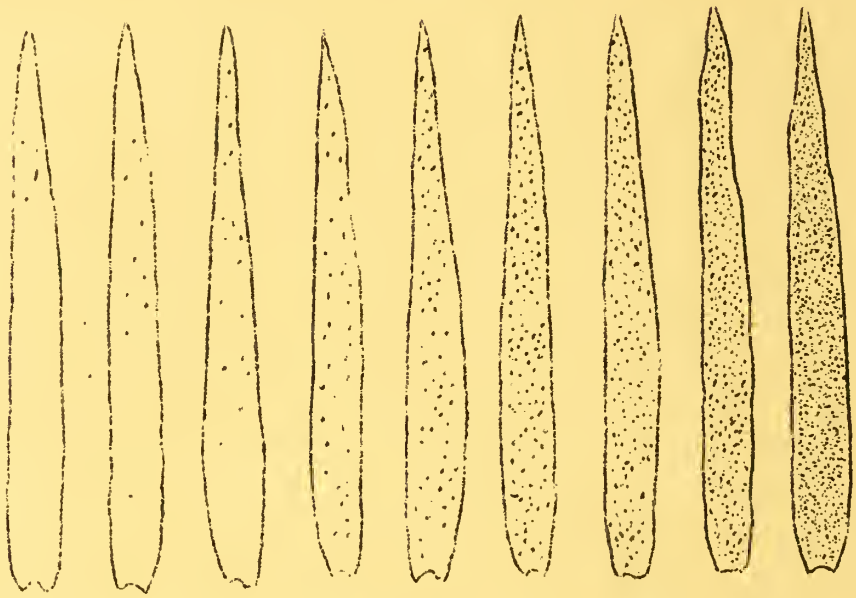
it were true that rust is progressively less from below upward, knowledge of the position on the plant of any given leaf, together with the degree of its rustiness, would give an approximate picture of the rust intensity for the plant. Litvinov's scale could only be used if rust actually is proportionately less the higher the position of the leaf. Against this assumption Rusakov (27, 43) offers 4 objections: (a) As Litvinov himself recognized, rust does not always proceed from the lower leaves upward, although this is the rule in warmer regions where the moisture conditions about the lower ranks of leaves are more favorable for rust infection. In cases of late-appearing rust in the colder part of Russia (Amur province), Rusakov points out, the uppermost leaves may be most heavily infected, the middle leaves less so, and the lower leaves not at all. (b) Rusakov also emphasizes the importance of including the amount of dead foliage in rust appraisal. This is an indication of the amount of damage done by the rust. In addition, rust may be much more apparent on a plant that still retains a considerable amount of green leaf tissue, as compared with one in which most of the foliage has succumbed, yet the latter may have suffered the more severely from rust. (c) Rusakov also points out that if 2 leaves at different position on 2 plants have an identical degree of rustiness, the plants may be suffering damage of different degrees, since the different leaves on a cereal plant have different functions; the lower ones contribute principally to the vegetative development of the plant, while the upper leaves serve almost exclusively to fill the grain. Hence a given amount of rust on upper and lower leaves respectively may have quite different physiologic effects in the two cases. (d) Finally Rusakov observes (43) that of 2 cereal varieties, variety A may have rust on the first 4 tiers of leaves, counting from the top, to the extent of 4, 4, 4, and 3-1/2 Russian units (see Fig. 1), while variety B has 4, 3-1/2, 3, and 2 units of rust on the corresponding leaves, the former having been infected more strongly and earlier than the latter. If only the top, most heavily infected rank of leaves is appraised, the 2 varieties would be scored as equally strongly affected, but actually variety A has more than twice as many rust pustules per plant.

In an endeavor to obviate some of these difficulties and proceed in the direction of greater accuracy in determining degrees of rust intensity, Rusakov (25, 27, 43) developed the following method, which has since been widely accepted and followed by Russian workers:

A diagrammatic scale of 9 degrees of rustiness was prepared as a standard with which to compare rusted leaves. This scale is shown in Fig. 1, together with the numerical symbols 0, 1, 1-1/2, 2, 2-1/2, 3, 3-1/4, 3-1/2, 3-3/4, and 4 "balla" (hereinafter referred to as "Russian units) applied to each grade of rust, and a comparison with the approximate equivalents on the Cobb scale and its American modification. It is seen from the figure that Rusakov's scale includes 3 degrees of rust intensity in the low rust range that have no counterpart in the other scales, in accordance with his observation that 10, 15, and 20 rust pustules per leaf respectively in the first 2 weeks of rust development may lead to major differences in grain yields in the 3 cases.

The Russian scale has degrees of rustiness that progress in logarithmic order; each stage represents approximately double the number of rust pustules per leaf as that of the next lower stage. To reduce the system of

Figure 1. Comparison of Rusakov's rust intensity scale with the Cobb scale and it
American modification.



Rusakov Scale:										Designatio of intermedia points:
Russian units:	1	1½	2	2½	3	3¼	3½	3 3/4	4	1-1½, e
Equivalent to no. pustules:	1-5	6-12	13-25	26-50	51-100	101-175	176-325	326-500	Over 500	
Corresponding values in Cobb scale:	-	-	[illegible]	1%	5%	10%	20%	-	50%	20+, 50- etc.
Corresponding values in USDA modification of Cobb Scale:	-	-	[illegible]	5%	10%	25%	40%	65%	100%	15%, 85% etc.
Russian equivalent units (See text):	.01	.03	.07	.15	.30	.55	1.0	1.65	2.6	

Russian units of estimation to values that may be used in arriving at a single figure representing the degree of rustiness of a whole plant, Rusakov (43) furnishes the "equivalent units" given in the bottom row of Figure 1. These represent the actual number of rust pustules, one equivalent unit corresponding to 250 pustules per leaf. In appraising a variety for rust, the various ranks of leaves (usually 4) are scored in Russian units, these are converted to equivalent units, and the latter are summated to give a figure for the total rust present on the entire plant. Thus in the example given above, of the 2 varieties A and B, A would have had 2.6 + 2.6 + 2.6 + 1.0 = 8.8 equivalent units, while B would have had only 2.6 + 1.0 + 0.3 + 0.07 = 3.97 equivalent units or a total of less than half as much rust as variety A.

This scale is applied to the leaf rusts with the exception of stripe rust (Puccinia glumarum (Schmidt) Erikss. & Henn.) in which case Rusakov follows Naumov's procedure (21) of estimating the percentage of the leaf area involved by rust, unless the number of pustules is less than 20, in which case the number of pustules is stated (Table 1).

Table 1. Rusakov's scale for estimating intensity of stripe rust

Rust stage	% leaf occupied by rust	:	Rust stage	% leaf occupied by rust	:	Rust stage	% leaf occupied by rust
1	1-4[a]	:	5	30	:	9	70
2	5[b]	:	6	40	:	10	80
3	10	:	7	50	:	11	90
4	20	:	8	60	:	12	100

[a] Corresponds to 20-90 pustules; [b] corresponds to 100-250 pustules; if number of pustules < 20, the number is stated.

2. Procedure of appraising rust intensity. In general the Russian workers have made a practice of appraising each examined cereal field several times in the course of a growing season. Rusakov (27) recommends 6-7 examinations during the vegetative period, at about 10-day intervals, and emphasizes the particular importance of examinations just prior to heading, at the beginning of blossoming, and in the milk and waxy stages; Brizgalova (3) followed a similar practice.

Furthermore, Rusakov, Naumov, and others feel that it is necessary to treat the different ranks of leaves individually in the examinations. The recommendations on methods of sampling cereal fields given by these 2 workers, which are representative of Russian practices, are as follows:

Naumov in 1924 divided plant diseases into 2 categories: (a) those in which we are interested in the degree of infection and where there is not a simple correlation between the degree of infection and the amount of damage caused by it (e.g. cases of cereal rusts, leaf spot diseases, most downy and powdery mildews, most scab diseases, etc.); and (b) those in which the essential feature is the quantity of infestation, where there may be a direct and simple correlation between the quantity of infestation and that of the loss it produces (e.g. smuts, damping-off, ergot, plum pockets, etc.). The methods of sampling and calculating data differ somewhat in the 2 cases.

Naumov's procedure requires the taking of data of the following types: degree of infection (d); total number of suscept organs per plant (m); number of suscept organs infected per plant (x); total number of plants per field or plot (N); number of infected plants per field or plot (N'); total number of fields or plots per region, experiment, etc. (Q); and number of infested fields or plots per region, experiment, etc. (Q'). Of these quantities, d applies only to diseases in the first category and in the case of cereal rusts is determined by use of one of the scales described in the preceding section; in the case of diseases of the second category, d is total or unity (i.e. except in rare cases a smutted head or ergoty floret is totally worthless). In work with large populations of uniform plants, e.g. cereal fields, N for practical purposes $=\infty$ and thus N and N' are expressed not in absolute terms but as percentages, N equalling 100%.

With cereal rusts, Naumov's procedure involves determination of degrees of infection for top leaves and middle leaves independently, and if necessary, other additional ranks of leaves; he does not specify the number of leaves or plants to be examined per assay, but presumably this would be determined by the degree of variability encountered. Having obtained an average for the degree of infection of all ranks of leaves examined (d) and counted the number of leaves per plant infected or not infected respectively, the work per field or plot is often completed, since with cereal rusts in advanced stages there is 100% infestation and N' = N. Naumov's method of calculating these data to get an over-all estimate of degree of infestation is given in the following section.

Rusakov's method (27) is somewhat less simple than Naumov's, since Rusakov includes data for each rank of leaves and for degree of leaf death as well as of rust infection. The procedure is as follows:

On the approach of the principal phase of plant development, 20 culms of average development are collected at points diagonal to and not less than 2 meters from one another, in places typical for height and density of the plant stand. For each rank of leaves is determined the average height of its attachment; degree of leaf death (in tenths of the leaf surface); and degree of rustiness in Russian units according to Rusakov's scale (Fig. 1). Stem rust is separately but similarly scored according to the respective nodes in which it is found. With such data taken at heading, milk, and waxy stages of plant growth, one has a measure of the dynamics of rust development in relation to time.

To American workers, accustomed to appraising the degree of rust intensity on hundreds of cereal varieties within a few hours, such procedures as those outlined above may seem far too laborious for ordinary practice. This is not necessarily true. With Rusakov's method, the more complex of the two, a worker can appraise 40 varieties in 8 working hours. In many cases, particularly in dealing with important genetic material or in technical studies on rust, the completeness, dependability, and comparability of such objective and accurate methods as those of Rusakov may well outweigh the limitation involved in the requirement of 12 minutes per appraisal.

When the rust is present in extremely small amounts, it is customary for the Russian workers to indicate its amount in terms of the number of minutes or hours of search necessary to find a given small number of infected

leaves (23, 26, 27, 29). One must admire the patience shown in such searches; Rusakov, for example, mentions many hours per day of fruitless search during 4 weeks (26), and in another case speaks of eventual success in finding 28 infected plants in a search of more than 3 hours (30). While the personal factor is an important variable in this method, it yields valuable data on the extremely important early spring cycles of infection. A better procedure in such cases would be to record the number of rusted plants found, in terms of the total number of plants examined, as Brizgalova had done (e.g. record of 23 infected plants found in 2000 examined). When rust was more abundant, the latter worker applied Rusakov's scale first to 1000, than 100, 50, and finally 25 diagonally-located plants at different places in the field (3).

3. Calculation of data. While Rusakov gives no special directions for reducing data taken by his methods to over-all averages, Naumov (21) clearly describes his method of accomplishing this by means of the diagram which is reproduced with slight revision in Figure 2.

Ducomet and Foëx (6) have published in French a review of Naumov's survey methods, but their account of his methods of calculation is so inaccurate that it will confuse rather than aid the reader. In turn, Ducomet and Foëx have offered their own suggestions on a method for appraising rust in cereals. In brief, their scale embraces 7 stages of rust designated by numerals, described by terms from "trace" to "enormous", and representing coverage of the leaf by rust pustules of from less than 1/20 to 3/4-total. Each organ of the plant is scored separately, head (glumes and awns, rachis, grain), each internode, numbered 1, 2, 3, etc. from above downward, each leaf and each leaf sheath similarly numbered, and each leaf is divided into proximal, medial, and distal sections and each of these is separately scored as to the degree of its rustiness. Each part that is scored is assigned a coefficient to weight the readings according to the importance attached to each, and the rust intensity is calculated by the use of previously prepared tables. At any given examination the authors recommend 6 scorings for heads and 3 each for leaves and stems, and they suggest that examinations be made at boot, heading, and post-blossoming stages of the host plant and 3-4 times thereafter.

The method of Ducomet and Foëx has as its goal the reduction of rust infection of the entire plant to a single absolute value. It is felt by the writer, however, that while granting the desirability of such an objective, and provisionally assuming that the procedure is theoretically sound, the amount of labor involved so reduces the number of examinations that are possible, that more accuracy may be lost through restriction of the number of specimens examined than is gained by the greater detail of each examination.

In passing, brief reference should be made to the method of evaluating cereal rust intensity that is in general use in the United States. Data are taken, with the aid of the U. S. Department of Agriculture modification of the Cobb diagrammatic rust scale, on severity (average degree of rustiness of leaves or stems), prevalence (percentage of plants affected in any degree), and response (type of lesion produced). The over-all expression of rust intensity is the coefficient, which is the product of severity x response.

1. Degree of disease per organ = d
2. No. infected organs per plant = x

Average infection of organs = $\frac{d_1 + d_2 + \text{--------} d_x}{x} = F$

3. Total no. organs per plant = m

Average infection of plant = $\frac{F.x}{m} = P$

4. No. infected plants per field = N'
5. Total no. plants per field = N

Average infestation of field = $\frac{P.N'}{N} = A$

6. No. infested fields in region = Q'
7. Total no. fields in region = Q

Average infestation of region = $\frac{AQ'}{Q}$

<u>Special</u> <u>cases</u>: When all plants are infected, $N' = N$ and $A = Fx/m$. When all organs on the plant are infected, $x = m$ and $P = F$; if at the same time all plants in the field are infected (a common case with cereal rusts), $A = F$. i.e. the average infestation of the field = the average infection of the organs of the average plant. For diseases in which d is unity or total (e.g. smuts), d can be omitted and $P = x/m$. For ergot, d, the degree of infection of the different spikelets, is constant, and can be omitted; here, however, an additional step in the observations is required, i.e. determination of the total number of spikelets per head and of the average number of these which are infected. If the fields of a region are not uniformly infected the last calculation would have the form $(A_1 + A_2 + \text{----} A_{Q'})/Q$ and it would be necessary to weight each "A" value according to the number of acres in the field.

<u>Figure 2</u>. <u>Naumov's (21) method for calculating disease intensities</u>. (Slightly revised. Means of gathering data are given in preceding section).

A comparable method has been proposed by Tehon (39). Diseased plants that are found are grouped according to their distribution in one or another of the grades (0, 5, 10, 25, 40, 65, and 100%) of the modified Cobb scale. The frequency of plants in each grade is multiplied by the percentage of that grade, these products are summated, the sum is divided by the total number of plants in all grades, the result, expressed as a percentage, is multiplied by the percentage of diseased culms in the field, and the final product is taken as a measure of estimated rust for the field.

III. METHODS OF DETERMINING DESTRUCTIVENESS OF RUSTS

Naumov has published a detailed review (22) of the various means used in Russia for determining the losses caused by cereal rusts. In the following account his classification is followed with some additions.

1. Greenhouse methods. Under the controlled conditions of the greenhouse it is not difficult to produce different degrees of rust infection on otherwise similar plants, to measure their respective yields, and thus to arrive at a conception of the damage caused by rust of definite intensity acting over a definite period in the life of the plant. No one can deny the possible error in equating such losses with those suffered by plants growing under natural conditions in the field, due to the artificial conditions of the greenhouse and the resulting abnormalities in host-plant development; however, such greenhouse tests undoubtedly cast some light on the destructiveness of rusts, particularly when their results are combined with those from other methods of study.

In addition to American work with this method, as exemplified in the studies of Mains (19) and Johnston (15), Naumov (22) reports that Rusakov and Shitikova in 1932 found in greenhouse experiments that if wheat was infected with leaf rust 2 weeks before heading, the rust becoming medium-strong before blossoming and remaining strong thereafter, yields were reduced by 70%; with similar infections that did not become strong until the milk stage the yield reduction was 59-62%. Rusakov (32) observed an 18% reduction in yield when greenhouse wheat plants were inoculated with leaf rust 4 or 6 days before the milk stage.

2. Method of artificially removing foliage. Since leaf rusts reduce the photosynthetic area of cereal plants, it might be thought that some clue as to the destructiveness of the rusts might be gained by artificially removing leaf tissue at different stages in the development of the host plant, and determining the influence of this on yield. Such experiments have been carried out by workers in various countries (Roebuck and Brown in England, Rudorf, Job, and Rosenstiel in Argentina, Kiesselbach in Nebraska, etc).

Russian workers have also used this method of investigating rust losses (Rusakov 31, 32, 43; Eidelman, 7, 8; Shevchenko, 36; and Lubimenko, mentioned in Naumov (22) without recognizable citation). Rusakov, for example, found that removal of one leaf 15 days before its normal death reduced grain yield by 10%. He also removed all leaves from plants that had the equivalent of 2-1/2 green leaves; a week later the non-mutilated check

plants had only 1-1/2 green leaves and 5 days later all had died normally. Despite this small difference in possible photosynthesis between mutilated and check plants, the latter produced 8.5% more grain than the former.

Eidelman (8) summarizes experiments with Telichko, Siriachenko, and Shevchenko in which 25 to 50% of wheat leaves were removed at different stages of plant development. Yields were reduced in proportion to the amount of foliage removed. In Belaya Tserkov yields were reduced 54.9% by removing all leaves at heading stage, while if only the lower leaves were removed in the blossoming to milk stage the reduction was 17-20%. At Kiev the yield reductions were less, which was attributed to growing conditions at Kiev that favored the greater photosynthetic activity of the remaining foliage.

It has been well pointed out by Shevchenko (36) that the results on yields of removing leaves are not entirely comparable to the destruction of those leaves by rust. In all probability the losses from leaf rust are greater than the leaf-clipping experiments would indicate, since rust, in addition to reducing photosynthetic surface also results in excessive transpiration such as does not occur in leaf-clipping experiments, and also, in the latter, the uncut leaves remain green longer than they would otherwise, and thus compensate to some extent for the loss of leaf tissue.

3. <u>Method of comparing yields in years of different rust severity</u>. If average cereal yields for a series of rust-free years are compared with yields during years of rust severity, other factors being as comparable as possible, the differences in yields in favor of rust-free years may serve as an index of the amount of loss caused by rust. This method of arriving at the extent of crop loss due to rusts has commonly been followed in early work with rusts and even up to the present, particularly in the United States.

The inadequacies of such a method are obvious. Severe rust losses occur in years of ample rainfall; and in regions in which low rainfall is a limiting factor in cereal production, the losses caused by rust in "wet years" may to a great extent be offset by the increased level of production due to adequate moisture for growth of the host plant. Hence in such areas the differences in yields between years of severe rust and rust-free years may indicate only a small part of the reduction in potential yields during years of rust severity.

Another grave fault in this method lies in the inability to give equal value to estimates of rust severity in different years. It has been well established in the United States, for example, that wheat leaf rust and the losses caused by it were grossly underestimated prior to 1930.

Naumov (22) cannot agree with Ruzinov (cited in 22; probably 34) that this method only leads to "absurd conclusions". Two comments seem applicable: (1) the value of loss estimates based on comparative annual yields increases with the number of positive cases in which lowered yields are associated with years of severe rust, and with the lack of conflicting cases it is a problem in the statistical treatment of heterogeneous data; and (2) again it may be emphasized that no method gives completely unchallenged results in determining rust losses, but the resultant conclusion

from several methods is highly significant; this method by itself may have but very limited value, yet it may be of considerable importance in serving to confirm and add to the testimony of other methods for determining loss due to rust.

4. The historical method. By this Naumov refers to a comparison of yields before and after some fundamental change has occurred in the culture or environment of the crop, such as to markedly affect its pathology; e.g., the widespread adoption of an effective control measure, or the general and destructive invasion of a crop by a formerly unknown or unimportant disease. Naumov's choice of barberry eradication in North America as an example was an unfortunate one; it did appear in the early 1930's that this had led to a fundamental increase in wheat yields through reduction of stem rust, but the epiphytotics of 1935, 1937, and 1938 fully disprove this thesis. A better example would be the case of sugar cane in relation to mosaic. The establishment of this disease was associated in Louisiana with a fall of sugar production from 400,000 tons to about 50,000 tons per year, and the subsequent adoption of mosaic resistant varieties raised production nearly back to its former level. Here the historical method affords striking and unequivocal evidence of the amount of crop loss caused by a plant disease.

5. Method of comparing yields of susceptible and resistant varieties. If 2 assortments of cereal varieties, one susceptible to rust, the other resistant, are found as groups to produce approximately equal yields under rust-free conditions, while yield advantage in the resistant group is seen when the 2 groups are exposed to rust, the yield difference may be taken as a measure of the loss sustained in the susceptible varieties as a result of the rust attack. The reliability of this method increases with the numbers of varieties in the groups, the equality of their yields in the absence of rust, and the correlation between rust intensity and yield difference.

Instead of grouping the varieties they may be arranged in a progressive series from the variety of highest yield to that of lowest yield under rust attack. If then the disease intensity is found to be inversely correlated with the yield for each variety, the relationship between rust increase and yield decrease is a measure of the loss caused by the rust, its reliability being determined by the height of the correlation.

Data of this sort may be treated by any of several methods. One of these is exemplified in Salmon and Laude's experiments with 24 varieties of winter wheats in Kansas in 1929 (35). When the varieties were arranged according to descending yield, disease intensities of the same varieties plotted on the same coordinates lay on a fairly regular ascending curve; i.e. the greater the rust in any given variety the less its yield, with high regularity.

Starkov (38) reports tests with 6 strains of wheat varying from highly resistant to highly susceptible toward leaf rust at 5 Russian experiment stations in 1933, 1934, and 1935. A striking advantage in yield is correlated with degree of rust resistance. For example, at Krasnodar in 1935 the resistant strains Kanred x Fulcaster, Illini Chief, and Hybrid 622 showed rust intensities of .05%, .12%, and .00% and yields of 31.7, 31.8,

and 29.0 tsenters/hectare respectively, while in the same test the susceptible strains Stavropolka 0328 and Ukrainka showed 68.5 and 65.0% of rust and yielded 17.0 and 10.5 ts./ha. respectively.

At the Omsk Experiment Station, Rusakov and Pokrovski (33) have noted that under rust-free conditions the susceptible soft wheats usually outyielded more resistant hard wheats by as much as 20%. Under the conditions of severe leaf rust in 1928, however, the latter outyielded the former by 41%, collectively and individually. Throughout the 1928 tests, yields and leaf rust intensity were inversely correlated between and within groups of varieties.

6. Method of comparing yields with degree of infection in selections from varieties or groups of lines from segregating hybrid familes. This method is a further refinement of the last, inasmuch as the resistant and susceptible plants are more comparable genetically. In the first case, it assumes that a disease-resistant selection from a disease-susceptible variety will differ little from the parent variety except in disease reaction and that a comparison of yields with disease intensity in the two cases will give a true picture of the effect of a given intensity of disease on yield. In the second case it assumes that a group of disease-resistant lines from a resistant x susceptible cross will differ from a group of susceptible lines from the same cross on the average principally in disease resistance alone; the larger the numbers of such lines used, the greater the probability that this will be true and that there will be a high correlation between disease differences and yield differences. An objection to the method is the theoretical possibility that the selection may differ from the parent variety in other characters of yield importance in addition to disease reactions, or of genetic correlations of such a nature that rust reaction and some other factor of yield importance do not segregate independently; there is no good evidence, however, that these have been faults in the majority of this type of experiments.

This method, which has often been used in the United States (e.g. in the work of Waldron (41) and Johnston (16)), has also been turned to good account with reference to wheat leaf rust by Shevchenko and by Rusakov's students Lukyanenko and Pronichev, and to stem rust by Rusakov and Panchenko (cited in 22). Lukayanenko (18), for example, grouped 187 wheat lines from crosses between susceptible and resistant parents into 3 classes, showing 0-5% rust, 25-40% rust, and 65-100% rust respectively. The least infected group exceeded the most heavily infected group in grain yield (av. 26.7%), yield of straw and chaff (25%), proportion of grain to bulk of the plant (11%), and 1000-kernel weight (17.1%), all with high statistical significance. The group of intermediate rust susceptibility was also intermediate in all of these yield factors.

7. Individual method. Ruzinov (34) believes that the only way of getting reliable results correlating rust severity with yields under field conditions is to select and compare individual plants from the same field, that differ in rust attack. Finding a correlation between shortness of culms and severity of rust, he recommends random collecting of severely, moderately, and slightly infected plants in a given field, grouping of the

plants in each infection class in 5-6 subclasses according to length of culm (exclusive of the uppermost node), and determining the yield in each class in relation to that of the subclass with the longest culms. His work was principally with stripe rust, to a less extent with stem rust and crown rusts. Naumov (22) feels that the method is highly accurate and may have promise, but needs much further testing, especially for leaf rusts.

A criticism that might be levelled regarding the individual method is this: if there is considerable variation in degree of rust attack among different plants in a field (and there must be for the method to be applicable) this variation must be the result of microclimatic differences (24) in the field, and these differences would have varying effects on the yields of individual plants quite apart from the influence of degree of rust intensity. In other words, the differences in yield obtained have been produced by a number of factors of which rust is only one, and it appears to the writer that errors from yield differences due to other factors than rust are likely to be much greater with the use of this method than with some of the other means of determining rust losses.

8. Comparison of yields from plots protected with fungicides with yields from unprotected plots. This method has been used more extensively than any other in determining cereal crop losses due to rusts and other diseases. American workers are familiar with the extensive work along this line that has been done in the United States (Galloway, 1894; Stakman, 1927; Mains, Caldwell, 1927-1934; Johnson, 1931; Decker, 1935; Butler, 1937-1940, etc.), in Canada (Greaney and Bailey, 1928-1941; Peturson and Newton, 1939), and in Australia (Neill, 1931; Phipps, 1938), and no attempt will be made to review this work.

In Russia work of this type has been done by Rusakov (in 22, 43), Pronicheva (in 22) and Brizgalova (3). Brizgalova's experiments are subject to the same criticism that applies to those of practically all other workers who have attempted to protect cereals from rust with fungicides, namely that dusting with sulphur was begun after the rust had already made enough headway to have become noticeable in the field. Her results in 3 years of extensive experiments with wheat leaf rust in Siberia show notable rust losses that could be reduced by protecting the plants with a fungicide, yet in all cases her comparisons are between different degrees of rustiness and not between rusted and non-rusted plants. To reduce her data to absolute terms she used a method of calculation which starts with an assumption of Rusakov's that 10% leaf rust has no significant effect on yield. The calculations proceed as in the following example. In 1933 control plants had 60% rust while dusted plants had 30%, and there was a 22.1% difference in yield in favor of the dusted plants. In 1934, when control plants had 30% rust and dusted ones 10% (considered as producing no loss), the latter outyielded the former by 9.7%. Therefore the absolute loss from rust in 1933 was considered to be 22.1% + 9.7% = 31.8%. In this way Brizgalova obtained values of yield reductions from rust varying from 9.7% (maximum of 30% rust in the waxy stage) to 70.2% (maximum of 100% rust in the blossoming stage).

Naumov (22) has justifiably criticized Brizgalova's method of treating

her data. She assumes that each equal increment in percentage of rust above 10% has an equal effect in reducing yields, which is questionable, and even if this were the case, the calculations should include reducing to terms of 100% and multiplying rather than adding.

The Russian workers, as Greaney and others, have found that the amounts of sulphur used in dusting have no fertilizing or other effect on the soil such as would influence yields independent of rust control (Shitikova-Rusakova and Rusakov, cited in 22).

9. Topographical method. As employed in Russia, this involves the selection in different parts of a field of groups of plants, each group differing from the others in the degree of its disease intensity, but in general being comparable to the other groups in other regards (variety, time of sowing, cultural practices, etc.). Protection from or exposure to environmental factors and exposure to air-borne inoculum are common reasons for such differences in disease intensity. The method has been used by Rusakov (25) and Grushevoi (cited in 22) with stem and crown rusts. Rusakov found yields ranging from 88.6 to 28.1 units in plant groups with from .3 to 3.6 Russian units of rust respectively. Grushevoi determined yields of 100, 81, and 55% in differently located plots showing little, moderate, and severe crown rust respectively. Naumov feels that this technique is very promising but needs more methodological study.

10. Comparison of anticipated with actual yields. Yields of cereals, when the harvest is in, are often but shadows of the bountiful crops anticipated by growers and crop scouts a month or two before harvest. Hail, drought, hot winds, floods, insect enemies, and diseases, any or several of these may have had their part in disappointing expectations.

As illustrated in the following example, a comparison of expected with actual yields, making due allowance for the various factors that have depressed the yields, is a means, albeit a very subjective one, of estimating the relationship between disease and crop loss. In 1921, a severe wheat leaf rust year in Indiana, Gregory (13) compared the wheat harvest anticipated in May with the actual yield in August, and dividing the difference among the different factors producing reduction in yield, placed the loss due to leaf rust in the neighborhood of 10%. Since time immemorial this has been the method of farmers in accounting for crop losses. Without an adequate background of understanding of the nature and relative importance of loss factors it may be inaccurate and misleading in the highest degree; the most recent, unusual, or most obvious deleterious factor is usually accused of all or nearly all of the destruction, and less obvious or less well-known factors may not enter into the account at all. The method of comparing theoretical and actual yields takes on some significance, however, when it is properly used with adequate understanding of the factors involved, as seen in the work of Shitikova-Rusakova cited by Naumov (22). She grouped culms according to amount of rust and determined the yields for each group. From these data she could plot a regression line depicting the relationship between percentage of leaf surface rusted (abscissa) and percentage of crop loss (ordinate). Actual losses (in tsentners per hectare or bushels per acre) could then be obtained by

solving for x (theoretical 100% yield) in the following proportion, and subtracting the actual yield from x.

Actual yield : x = (100% - % of crop loss (taken from regression line)) : 100%[1].

Fig. 3 gives the regression line in one of Shitikova-Rusakova's tests.

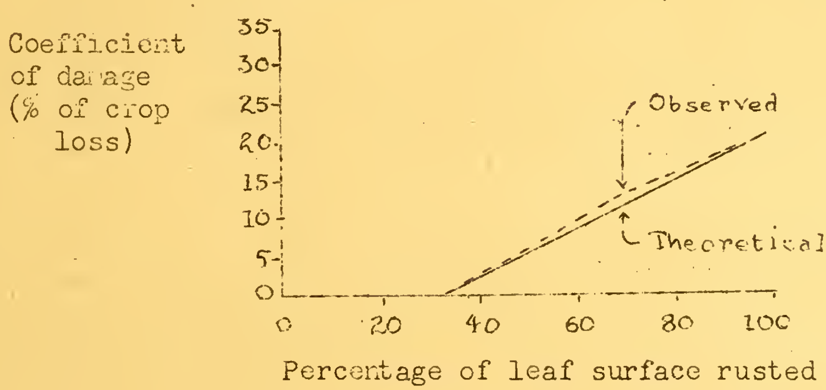


Fig. 3. Rust-loss relationship of wheat variety Ukrainka. Slope of curve indicates that for every 10% increase in rust, the yield is lowered 3.09 per cent. (From Shitikova-Rusakova, in Naumov, 22.)

11. Combinations of the above methods. A combination of the topographical method and that of sulphur dusting in the field was used to good advantage by Gassner and Straib in Germany (12). The principles were those of the topographical method (Subsection 9, preceding) except that Gassner and Straib created diversity among groups of plants in the field by a variety of treatments including protection from rust with sulphur, and variation of the planting date. A similar device has been used with the individual plant method (Subsection 7, preceding) by Shitikova-Rusakova (in 22).

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[1] This is essentially the method followed in calculating crop losses in the U. S. Dept. Agr. Pl. Dis. Reporter (Supp. 12:308. 1920 and Supp. 83: 1-3. 1932) with the exception that Shitikova-Rusakova has prepared her regression line by use of the formula: $M_y = R \frac{y}{x} (x - M_x)$ where M_y = average absolute grain weight observed from uninfected culms, $R \frac{y}{x}$ = the lowering of absolute weight according to height of culms in comparison with uninfected culms, x = average height of culm infected to any given degree, and M_x = height of healthy culms. The reason for including culm length in the calculations is to avoid errors due to differences in rust-yield relationships between main culms and secondary tillers. The measurement is made from the base of the culm to the insertion of the uppermost leaf.

Experiments of Brizgalova in dusting wheat, with a criticism of her method of treating her data, were reported in subsection 8. In addition she derived losses from wheat leaf rust in a "rust year" by comparing yields under conditions of various degrees of infestation with yields from comparable plantings in a "rust-free year." This gave a series of loss percentages that ranged from 1.01% loss with weak (40%) rust at the beginning of the milk stage to 67.5% loss with strong (100%) rust in the blossoming stage. These loss percentages were ranged beside the loss percentages that she obtained through her calculations from dusting experiments. For final estimations of losses she took the numerical mean of the 2 values for rust loss at each level of rust intensity. This procedure has the advantage of giving results that are the average of 2 distinct methods of work; thus errors introduced in either one procedure may be somewhat reduced.

12. The questionnaire method. The use of questionnaires should not be overlooked in an enumeration of the methods of arriving at estimates of crop losses due to diseases. Russian phytopathologists, as those in other lands, have exhibited some mistrust of the results of using questionnaires on plant diseases directed at laymen who usually have no background for evaluating pathological phenomena. Prior to embarking on the Russian program of research on the cereal rusts of the past 25 years, questionnaires were used to determine the status of these diseases in Russian cereal production. In some cases the results were none too good and at the All-Russian Botanical Congress in 1920 it was emphasized that in general only 10-20% of the questionnaires were returned. Rusakov (29), however, had a much better experience in 1924 when he sent 700 copies of a cereal rust questionnaire to correspondents (usually chancellors of the various governmental administrative units) in Siberia (Amur, Primorsk, and Za-Baikal provinces). Of these 54% returned the questionnaires duly filled out and often with additional comments.

With as many replies as this it is possible to attach significance to the summarized replies to some of the questions. With regard to importance of the cereal rusts and the damage caused by them, Rusakov was able to extract the following, apparently well-authenticated information: In eastern Siberia wheat suffers much more from rust than the other cereals; total crop losses from rust occur in all these provinces but especially in Primorsk[2]; between 1917 and 1926 there was a marked reduction in wheat acreage in Primorsk as a result of repeated losses from rust; rust was associated with lodging and early maturity; both leaf and stem rusts were involved; rust usually appeared suddenly, at heading to blossoming stage, or in most cases, soon after the blossoming stage. Other questions regarded environment in relation to rust.

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[2] Comments added were often significant: "Expected 75 pood (50 bu.) but obtained nothing"; "Crop entirely destroyed,--only straw; not gathered"; "No harvest whatsoever"; "Wheat was abandoned for grain".

The amount of detailed information gleaned by Rusakov from this questionnaire, which is little more than suggested in the preceding paragraph, well exemplifies the value of the questionnaire, under favorable circumstances, as a means of eliciting information on crop losses due to plant diseases. It is patent that individually most or all replies must be regarded with caution, and it is also well known that large majorities of layman correspondents can be mistaken on certain matters pertaining to plant diseases. Some of the shortcomings of the questionnaire decrease with increase in the number of correspondents and judgment with which they are selected, and if the information forthcoming is properly summarized and conservatively interpreted, the questionnaire can be a most useful survey tool.

13. Miscellaneous methods. The pathologist should be alert to discover clues of losses from plant disease in residues of the crop that for one reason or another have been preserved for several or many years. Rusakov (31) was able to determine the severity of rust and its presumptive destructiveness in early years, for which no field records were available, by examination of sheaves that had been preserved for exhibition or other purposes. The writer also found an interesting clue to the destructiveness of crown rust of oats many years past in the abundance of telial pustules present on the straw of a beehive that had been constructed as an exhibit to illustrate straw hives used in Russia.

Barclay in India (1) attempted to determine rust damage in early years by comparing the price of wheat in given years with the meteorological conditions known to be conducive to rust. While there were some inconsistencies there was evidence of a correlation between high prices, poor yields, and conditions favoring rust (high humidity in January-March). The limitations in this method are obvious: price is regulated by many factors other than crop catastrophes and many crop catastrophes other than rust; futhermore our knowledge of the environmental conditions necessarily associated with rust is far from adequate to lead us to the conclusion that a certain year must have been a "rust year" because of its weather. Despite these shortcomings, such a procedure as Barclay's is not entirely without value, as it does provide an inkling, even though it be a very conditional one, of epiphytotics of years long gone by.

14. Conclusions on methods of determining destructiveness of rusts. No one method for determining cereal crop losses due to rusts can be recommended to the exclusion of the others. Each has its advantages, its contributions, and its limitations. Certain methods can be used under circumstances where others cannot. Combinations of two or more methods are often much more desirable than one alone. The more methods that can be used to bring evidence to bear on this question, the more reliable will be the conclusions. Errors involved in the use of one method can be annulled or corrected by another.

Certain of these methods have been used to almost no extent in America, yet they have contributed valuable data in the hands of Russian phytopathologists; this applies in particular to the topographical and individual methods, and to some extent to the procedure of comparing anticipated

with actual yields. This last requires further methodological studies in regard to calculation of data, but has promise of being one of the most exact of all these techniques.

Comparison of yields, under rust attack, of host strains that are genetically similar but differ in rust susceptibility, if carried out on a scale that permits analysis of statistical significance of results, is a means of ascertaining disease-loss relationships that is deserving of much more attention by American workers. By such means as this, based on carefully conducted field experiments and judicious interpretation of data, we can provide the necessary background for rapid and accurate estimates of crop losses by field men in their plant disease surveying.

Any method of determining losses from crop disease depends first of all on accurate determination of intensity of disease and understanding of the dynamics of its development in relation to developmental stage of the host plant. The methods which we have used in appraising the intensity of cereal rusts are not beyond reproach. There is much merit in the methods used by Russian phytopathologists, particularly those of Rusakov described in Section II, preceding; these warrant our careful study, trial, and in some cases, perhaps, our adoption of them or modifications of them in which their better features are presented.

While this review has been concerned almost exclusively with cereal rusts it will be apparent to the reader that the techniques described have a much broader application in the field of plant disease surveying. To cite but a few examples: workable diagrammatic scales, such as are used for rusts, and such as Tehon (39) has prepared for leaf spot disease of oats and wheat, might well be applied to the more exact determination of intensiveness of leaf spot diseases of many other crops besides cereals; the methods of comparing yields of varieties or strains that are genetically similar but differ in disease resistance should prove useful in determining loss from such diseases as bacterial blight of cotton, in which the disease produces such diverse types of injury as almost to defy attempts at loss estimation by other methods; the topographical and individual methods that have hardly been recognized in America, offer possibilities for accurate disease-loss determinations for a variety of types of plant diseases. Except in a few instances, the lack of system and the crude approximations of many of our survey methods today demand that our minds and experiments be directed at plant disease surveying at the research level if the results of our surveying in years to come are not to be huge masses of indigestible data incapable of analysis and synthesis into basic phytopathological principles.

IV. APPENDIX. EXAMPLES OF WHEAT LOSSES FROM RUST (PRINCIPALLY *Puccinia triticina*) IN RUSSIA.

Year	Geographic area	% loss	Rust species	Authority	Reference
General	Russia except North Caucasus	10-20	P. triticina	Grooshevoi & Maklakova	14
1927-32	Russia (average)	10	P. triticina	Shitikova-Rusakova	37
1921	Asiatic Russia	71	P. triticina	Estifeev	10
1926	Asiatic Russia	>75	P. triticina, P. graminis	Rusakov	28
1927, 1932	Asiatic Russia	30-35	P. triticina	Brizgalova	3
1928	Omsk	41	P. triticina	Rusakov & Pokrovski	33
General	North Caucasus; Southern Ukraine	50 often	P. triticina	Grooshevoi & Maklakova	14
1932-37	North Caucasus	50	P. triticina, P. graminis, P. glumarum	Beilin	2
1933	Krasnodar	27.7	P. triticina	Lukyanenko	18
1935	Verblud	50	P. triticina	Pronicheva	In 22

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SUPPLEMENT 147

PLANT DISEASE SURVEYS

IN THE NORTHEASTERN UNITED STATES IN 1943

June 1, 1944

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Plant Disease Reporter
Supplement 147

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CONTENTS

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IN THE NORTHEASTERN UNITED STATES IN 1943

FOREWORD

The following summaries report the result of surveys conducted by members of the Emergency Plant Disease Prevention Project of the Bureau of Plant Industry, Soils, and Agricultural Engineering. Since the inclusion of all the summaries in one supplement would result in a volume too bulky for easy handling, the material has been divided on a roughly geographical basis, as follows:

Supplement 147 -- Northeastern United States, including the area north of the Ohio and Potomac Rivers, west to Minnesota and Iowa.

Supplement 148 -- Southeastern United States, south of the Ohio and Potomac, west to Missouri, Arkansas, and Louisiana.

Supplement 149 -- Western United States from the Great Plains States westward.

The considerable variation in the conditions under which the surveys were conducted in the different States has resulted in a corresponding variation in content and form of the summaries, and no attempt has been made to have them conform to a uniform method of presentation. Some of them report only data obtained during the surveys; while in others information from additional sources has been incorporated into a more complete account of disease occurrence in the State during the season.

In all cases the surveys were planned under the supervision of the collaborators and other pathologists in the States concerned, and made with assistance from them as well as from county agents and numerous other persons, whose aid is acknowledged and appreciated.

PLANT DISEASES IN NEW ENGLAND, 1943

Robert C. Cassell

References are made throughout the New England report to drought areas and areas of excessive rainfall. The following table, showing the monthly precipitation and departures from the normal, by States, will help to explain some of the unusual situations.

Total Monthly Precipitation and Departures from Normal during the Period April to September, 1943, in the New England States. (Information from U. S. Weather Bureau, Boston)

Month		Precipitation (inches) in					
		Vermont	New Hampshire	Maine	Massachusetts	Connecticut	Rhode Island
April							
Total		3.45	3.50	2.73	3.49	3.40	3.38
Departure:	+	0.58	0.45				
	-			0.36	0.05	0.26	0.24
May							
Total		5.75	4.51	3.99	5.56	5.15	3.04
Departure:	+	2.54	1.36	0.83	2.24	1.48	
	-						0.28
June							
Total		4.24	4.72	4.49	2.31	3.31	1.49
Departure:	+	0.60	1.13	1.00			
	-				1.17	0.21	1.58
July							
Total		4.39	4.72	3.90	4.80	3.46	2.79
Departure:	+	0.61	1.00	0.53	1.24		
	-					0.51	0.28
August							
Total		5.30	5.21	4.61	2.48	1.62	2.12
Departure:	+	1.75	1.66	1.30			
	-				1.19	2.51	1.55
September*							
Total		2.08	1.99	2.55	1.49	1.50	1.32
Departure.	+						
	-	1.65	1.74	1.08	2.27	2.45	2.11
Total for period		25.21	24.65	22.27	20.13	18.44	14.14
Departure:	+	4.43	3.86	2.22			
	-				1.20	4.46	6.22

* Not final, subject to possible slight correction

The actual drought area of New England in 1943 included Connecticut, Rhode Island, and southern and eastern Massachusetts, and extended as far north as Portland, Maine, constituting a coastal belt line terminating at the north in lower Maine. Yields of all mid-summer and fall crops were appreciably lowered unless irrigation was employed. Apple and potato yields were strikingly affected. In Connecticut and Rhode Island apple yields were reduced probably 25%, principally through reduction in size of fruits, and potato yields were lowered 30 to 50%. In Massachusetts, even in the Connecticut Valley and the Berkshire Hills to the west, potato yields were 10 to 40% below normal. These lowered potato yields include reductions due to all contributing factors, among which aphids, leafhoppers, and flea beetles played no small part this year. In Maine, on the other hand, the 71,040,000 bushel potato crop was figured at an average yield of 370 bushels per acre, which is considered a very good yield.

DISEASES OF VEGETABLE CROPS

ALLIUM CEPA, ONION

Colletotrichum circinans, smudge. A single light case was found in some recently stored onions in Waltham, Massachusetts. Damage was slight.

Fusarium sp., root rot. From a July observation of O. C. Boyd and Thomas Sproston, Jr., it is noted that root rot was more prevalent than usual in Massachusetts, especially in set onions. Where observed, from 5 to 35% of the plants were affected, with premature lodging and death of tops accompanied by some bulb decay. Moderate to heavy losses were expected in storage.

Peronospora destructor, downy mildew, was severe in Presque Isle, Maine, according to Reiner Bonde.

Phoma terrestris, pink root, was reported once in Connecticut.

Urocystis cepulae, smut. Early in the season smut was more pronounced than for several years in the Connecticut River Valley of Massachusetts. A 30% reduction in yield was found in 1 field of seeded white pickle onions.

APIUM GRAVEOLENS, CELERY

Cercospora apii, early blight, was generally prevalent in Connecticut, Rhode Island, and Massachusetts, but damage was apparently less than in most seasons. Only a few isolated severe cases were noted and these were due either to infrequent copper applications or to the use of overhead irrigation.

Septoria apii, late blight, was found in Connecticut, Rhode Island, Massachusetts, and New Hampshire, but was much less prevalent generally than early blight. A few isolated cases of 4 to 6% damage occurred, but in general no appreciable damage was noted where adequate protection was furnished.

Black heart (physiogenic). Two severe cases were noted in Massachusetts; one case was an almost total loss of a 7-acre field. A case of slight proportions was found in Connecticut.

ASPARAGUS OFFICINALIS, ASPARAGUS

Puccinia asparagi, rust. In spite of the serious outbreak of rust in Massachusetts in 1942, the disease did not appear this year until September 17, about 2 months late. One severe case was observed on Mary Washington late in September. Losses were negligible in Massachusetts in 1943, and no rust was found in the other New England States.

BETA VULGARIS, BEET

Actinomyces scabies, scab. One moderate case was reported in Connecticut.

Cercospora beticola, leaf spot. Light infections were recorded in scattered areas in Connecticut, Rhode Island, and Massachusetts.

Phoma betae, root rot. One light case was reported in Connecticut.

BETA VULGARIS var. CICLA, SWISS CHARD

Cercospora beticola, leaf spot. A 100% infection was observed in 1 home garden in Bristol County, Massachusetts, with moderate damage.

BRASSICA CAMPESTRIS, RUTABAGA

Cercosporella albo-maculans, white leaf spot, was generally spread over one field in Massachusetts. Damage was severe in spotted areas of the field.

Xanthomonas campestris, black rot, was general in one field in Massachusetts, with very slight damage.

BRASSICA OLERACEA var. BOTRYTIS, CAULIFLOWER

Alternaria circinans (A. brassicae), black leaf spot, was recorded in Connecticut and Massachusetts, but prevalence was far less than in most past years. Slight to moderate damage was recorded in 3 Massachusetts fields.

Plasmodiophora brassicae, club root, was found in 1 field in Massachusetts and 1 field in Maine. Except for an occasional severely stunted plant, loss was slight.

Pseudomonas maculicola, peppery leaf spot. A light localized infection was observed in 1 field in Massachusetts. The disease was far less prevalent than usual.

BRASSICA OLERACEA var. BOTRYTIS, BROCCOLI

Alternaria circinans (A. brassicae), black leaf spot, was recorded in Connecticut, Massachusetts, and Vermont. It was usually confined to the lower leaves and in no case was any appreciable damage involved.

Peronospora parasitica, downy mildew, was recorded once, in Massachusetts, with no damage.

BRASSICA OLERACEA var. CAPITATA, CABBAGE

Alternaria circinans (A. brassicae), black leaf spot, was recorded in Rhode Island, Massachusetts, and New Hampshire, but never in serious proportions. It was usually confined to the older leaves with practically no damage involved.

Fusarium oxysporum f. conglutinans, yellows, was reported from 3 counties in Massachusetts and 1 in Connecticut. A 25% loss was estimated for one Massachusetts field, and 20% for another. Growers are rapidly turning to resistant varieties. In Massachusetts, yellows was reported from Bristol County this year for the first time.

Peronospora parasitica, downy mildew, was rather prevalent on the early and second-early crops in Massachusetts, but was less prevalent on late cabbage than usual. Infection was usually confined to the lower leaves and no severe damage was recorded.

Phoma lingam, black leg, was observed in various places in Massachusetts. Severity ranged from traces to very light infections. The disease was less extensive and damaging this year than usual.

Plasmodiophora brassicae, club root, occurred in rather serious proportions in certain areas of Massachusetts and Maine this year. Home gardens as well as commercial fields were affected. The most serious case observed was 25% loss in 1 field in Maine.

Xanthomonas campestris, black rot, was found in Connecticut, Rhode Island, and Massachusetts. The disease accounted for a 5 to 10% loss in 1 field in Rhode Island and a 90% loss in 1 in Massachusetts. In general black rot was scarcer in New England this year than in most past seasons.

BRASSICA PEKINENSIS, CHINESE CABBAGE

Alternaria circinans (A. brassicae), black leaf spot. A single record was made in New Hampshire, of no damage.

CAPSICUM FRUTESCENS, PEPPER

Xanthomonas vesicatoria, bacterial spot. A single case of leaf spotting but no fruit infection was observed in eastern Massachusetts. Damage was not appreciable.

Mosaic (virus) was found in Connecticut, Rhode Island, and Massachusetts, and appeared as the most serious disease of peppers in New England. Most fields had from a trace to 10% infection with an occasional field, especially in Connecticut, showing up to 50 or 60%.

Blossom-end rot (physiogenic) was quite common throughout Connecticut. The damage ranged from slight to moderate depending upon the location.

Sun scald (non-parasitic) appeared in severe proportions, especially in victory gardens of the New Haven-Hamden area of Connecticut.

CITRULLUS VULGARIS, WATERMELON

Colletotrichum lagenarium, anthracnose, was recorded from a single planting in Rhode Island. Here some of the fruits were badly marked, probably reducing the sale value of a quarter of the crop.

CUCUMIS MELO, CANTALOUP

Alternaria cucumerina (Macrosporium cucumerinum), leaf blight, occurred in approximately the same proportions as scab and anthracnose.

Cladosporium cucumerinum, scab, occurred as light infections in several counties of Massachusetts, without appreciable losses, decidedly lower this year than usual.

Colletotrichum lagenarium, anthracnose. Occurrence was approximately the same as for scab.

Erwinia tracheiphila, bacterial wilt. Light infections were noted in several Massachusetts counties. Losses were very light.

Fusarium sp. and Verticillium sp., root rot, wilt, caused heavy losses on 2 Massachusetts farms. In both fields most of the plants of all varieties were wilting and dying prematurely from root dieback and cankers.

Pseudoperonospora cubensis, downy mildew, was found in Connecticut, Rhode Island, and New Hampshire. In Rhode Island it was widespread and accounted for considerable damage, even to total loss. It was found in small amounts in a single field in Connecticut and New Hampshire.

Septoria sp. (probably cucurbitacearum), leaf spot, occurred as local light infections in 2 Massachusetts counties.

Mosaic (virus). One observation, of 50% infection, was made in Massachusetts.

CUCUMIS SATIVUS, CUCUMBER

Cladosporium cucumerinum, scab, was found in Massachusetts and Maine. It became widespread and damaging in Massachusetts about August 15. Scab ran its usual course in the upper Connecticut River Valley but was much less severe in the drier sections of the southern and eastern parts of the State. Scab was found in 2 places in Maine, but only around La Grange was the damage severe enough to reduce the market value appreciably.

Colletotrichum lagenarium, anthracnose, was found in Massachusetts and Vermont. About 50% of the fields observed in Massachusetts had foliage infection this year, with actual losses light. Anthracnose caused some loss in victory gardens in Burlington, Vermont.

Erwinia tracheiphila, bacterial wilt. Boyd and Sproston report that bacterial wilt was first observed in Massachusetts June 26; later it could be found in practically every field and garden visited. Losses ranged from about 5% to 50% of the plants, in spite of the fact that the disease was generally less damaging than in most past seasons.

Erysiphe cichoracearum, powdery mildew, was found in one location in New Hampshire. Prevalence was general in this field, but damage was very slight, if any.

Pseudomonas lachrymans, angular leaf spot. Following bacterial wilt and scab, angular leaf spot was the next most widely distributed disease of cucumbers in Massachusetts. Prevalence was general but infection was mostly light except under irrigation in the eastern part of the State, where the disease was most severe. Angular leaf spot was quite general in the Portland=Scarboro area of Maine, and caused some appreciable losses in the Portland region.

Pseudoperonospora cubensis, downy mildew, appeared in Massachusetts the second week of September and later was found in most sections of the State. Some heavy losses were suffered in the eastern part, especially in Bristol and Plymouth counties where there were 2 known cases of 75 to 80% losses. F. L. Howard also reports downy mildew in Rhode Island.

Mosaic (virus) appeared somewhat later than usual this season but spread rapidly after the delayed start. It was found in Connecticut, Rhode Island, Massachusetts, Vermont, and Maine. There was a probable loss of 20 to 25% of the Connecticut River pickle crop, with less damage to the

slicing cucumbers. There was also probably 5 to 10% loss to the cucumber crop in eastern Massachusetts, the Burlington area of Vermont, and the La Grange area of Maine.

Sun scald (non-parasitic). Early leaves were badly damaged by sun scald, followed by later recovery of the plants in the Mansfield, Connecticut area.

CUCURBITA MAXIMA, SQUASH, and CUCURBITA PEPO var. CONDENSA, SUMMER SQUASH

Alternaria sp., fruit rot, was found in several locations late in the season in New Hampshire, and in Burlington, Vermont. Losses were negligible, if any, as only immature fruits appeared susceptible.

Alternaria cucumerina (Macrosporium cucumerinum), leaf blight, caused no damage as it appeared on immature fruits late in the season in east-central Massachusetts.

Choanephora cucurbitarum, brown rot, blossom blight, was found in Connecticut, Rhode Island, Massachusetts, and New Hampshire. It was very severe in Rhode Island, where a loss in set of 2/3 of the summer squash and 1/2 of the winter squash was reported. In Massachusetts losses were heaviest in the eastern part, where they were recorded as slight to moderate. Moderate losses occurred in the Hamden, Connecticut area, while in New Hampshire brown rot was well distributed but the loss light.

Cladosporium cucumerinum, scab, was observed only in Massachusetts, where its occurrence on summer squash was much less common than usual. It appeared to be most prevalent in the western part. On winter squash in storage scab seemed confined to the seconds or immature small squashes.

Colletotrichum lagenarium, anthracnose, was found only in New Hampshire, but was generally prevalent there in the Litchfield=Pittsfield-Barnstead area. Damage to the fruit ranged from slight to moderate.

Erwinia tracheiphila, bacterial wilt, was found in Massachusetts, Rhode Island, and Maine. It was generally common but less extensive and damaging to summer squash than usual; more damage, although light, was caused to fall and winter varieties in Massachusetts. Only one case was found in Maine, at Scarboro, with very slight damage.

Erysiphe cichoracearum, powdery mildew, was found generally prevalent in Connecticut, Rhode Island, Massachusetts, Vermont, and New Hampshire. It was much more severe in southern New England than in the northern part. In the southern section, greatest damage was caused to foliage early in the season, while new leaves produced under drought conditions later were almost free from mildew. Many older leaves of the plants were killed by the disease, and severe stem infections were common.

Fusarium solani var. cucurbitae, foot rot, was generally distributed in Connecticut, damage appearing moderate to severe.

Mycosphaerella citrullina, leaf spot, was observed on the aging foliage of winter squash in east=central Massachusetts late in the season.

Pseudomonas lachrymans, angular leaf spot. A single case with very light infection was found in Portland, Maine.

Pseudoperonospora cubensis, downy mildew, was found on summer and winter squash in Bristol County and on summer squash only in Middlesex and Plymouth Counties, Massachusetts. Infections were mostly light to moderate but in some fields of summer squash there were areas of marked de-

foliation. Boyd reports this to be the first outbreak of downy mildew on squash in Massachusetts since 1932. Downy mildew was also found in Rhode Island.

Rhizopus sp., black mold rot, was found in 2 fields in southern New Hampshire. Damage was negligible as the rot appeared late in the season on immature fruits.

Septoria cucurbitacearum, leaf spot, was observed in Franklin, Hampshire, and Middlesex Counties, Massachusetts. In Franklin County heavy foliage spotting caused moderate damage to the crop in 1 field.

Mosaic (virus) was present throughout most of Massachusetts and the Connecticut River Valley of Connecticut. In Middleton, Connecticut, damage was most severe; many fruits were not marketable. Mosaic was less severe in Massachusetts than in most past seasons.

Yellows (aster yellows virus). One case was observed in Maine, with practically no damage.

Sun scald (non-parasitic). In the Mansfield, Connecticut area the early leaves were badly damaged by sun scald.

CUCURBITA PEPO, PUMPKIN

Erysiphe cichoracearum, powdery mildew. A single case was noted in Kingston, Rhode Island, where the disease was general in the field and considerable damage followed severe defoliation.

Pseudoperonospora cubensis, downy mildew. A single case of light to moderate infection with no appreciable damage was observed in Bristol County, Massachusetts.

DAUCUS CAROTA, CARROT

Cercospora carotae (C. apii var. carotae), leaf spot, and/or Alternaria carotae (Macrosporium carotae), leaf blight, were observed in Connecticut, Rhode Island, Massachusetts, and Vermont. These 2 leaf diseases appeared late but became fairly widespread and caused some loss in local areas. One large field in Southington, Connecticut, suffered a loss of about 1/3 of the total leaf area. Some noticeable loss occurred in Apponaug, Rhode Island. Most severe losses probably occurred in Hampshire and Franklin Counties, Massachusetts, where yield reduction amounted to 15 to 20%, mostly from Cercospora. In the Burlington-Essex Junction area of Vermont losses were light and confined to victory gardens.

Yellows (aster yellows virus) was observed in all the New England States. Infection was scattered with no serious losses anywhere. Losses probably reached 5% in a few fields.

Root branching (non-parasitic). A single case of 100% loss was observed in a 5-acre field in Southington, Connecticut. Dry weather and a hard-pan soil appeared to be causing the roots to develop from 2 to 4 branches.

LACTUCA SATIVA, LETTUCE

Septoria lactucae, leaf spot, was found in Massachusetts, Vermont, and Maine, causing only slight damage to the leaves in most cases. Moderate to severe damage was noted in 1 irrigated Massachusetts field.

Yellows (aster yellows virus) was the principal disease observed in

August in all sections of Massachusetts. It was most prevalent in the drier eastern counties where infection ranging from 10 to 70% and losses from a trace to 50% were observed. The disease was also the source of considerable concern in the Portland-Scarboro area of Maine, where most growers suffered from 25 to 35% loss.

LYCOPERSICON ESCULENTUM, TOMATO

Alternaria solani, early blight, was found generally distributed throughout New England. No appreciable losses were observed in Vermont or Maine, and only 1 case was found in New Hampshire where defoliation was severe enough to reduce the yield. A few scattered cases of serious defoliation were found in Rhode Island, and 1 case in Connecticut where damage was slight to moderate. In Massachusetts a field of Bonny Best in Worcester County suffered 25 to 35% defoliation. A planting of the same variety in Hampden County was reduced 30 to 35%. In 1 large field of trellised Comet in Plymouth County, the disease caused failure of the first 2 or 3 hands, severe defoliation, and a 25% reduction in yield. Except for these cases cited in Massachusetts, early blight was less damaging late in the season than in most former years.

Cladosporium fulvum, leaf mold, was found in field plantings in Connecticut, Rhode Island, Massachusetts, and Maine. In Connecticut damage to the foliage ranged from slight to moderate in Hamden and New Haven. J. G. Horsfall reported that leaf mold was the general complaint of victory gardeners in New Haven. The disease apparently caused no noticeable losses to field tomatoes in Rhode Island, Massachusetts, or Maine, although some losses were known to occur in greenhouses in Rhode Island and Massachusetts.

Colletotrichum phomoides, anthracnose, was observed in Connecticut, Rhode Island, and Massachusetts. Most severe infections occurred in Rhode Island where the disease was recorded in Kingston, Apponaug, and Newport. In Newport fruit infection prevented harvesting of practically all of the later fruits. Occurrence was least extensive in Massachusetts.

Corynebacterium michiganense (Phytomonas michiganensis), bacterial canker, was common in the Waltham section of Middlesex County, Massachusetts. One grower there lost his entire crop of Victor and up to 70% of other early=planted varieties.

Fusarium oxysporum f. lycopersici (F. bulbigenum var. lycopersici), Fusarium wilt. One case with moderate damage was noted in southern Essex County, Massachusetts.

Phytophthora infestans, late blight, was observed in Massachusetts, Vermont, New Hampshire, and Maine. In Scarboro, Maine, it was found spreading from potatoes to tomatoes on August 22, when infection spots were evident on the tomato fruits. Subsequently, tomatoes throughout Maine became infected and considerable loss of fruit resulted. Some fruit infection was found in southern New Hampshire about the middle of September. Considerable loss of fruit occurred as far north as Burlington, in Vermont. In Massachusetts a limited amount of fruit loss occurred in a few scattered areas.

Septoria lycopersici, leaf spot, was found in Connecticut, Rhode Island, Massachusetts, and Vermont, in widely scattered areas and in varying amounts. Infection ranged from very light to moderately severe.

Verticillium sp., verticillium wilt, was observed in 1 field in eastern Plymouth County, Massachusetts, where it was causing slight to moderate damage.

Blossom-end rot (physiogenic), accompanied by physiogenic fruit-cracking and sun scald, accounted for the greatest loss to tomatoes in Connecticut, Rhode Island, and eastern Massachusetts, the drought area of New England. In eastern Massachusetts Boyd estimated from 5 to 10% loss due to blossom-end rot; in Rhode Island Howard estimated 5% loss; and in Connecticut the loss was at least 5 to 10%.

Mosaic (tobacco mosaic virus) was found in Connecticut, Massachusetts, and New Hampshire. Occurrence was rather scattered in Connecticut and Massachusetts, but was always most serious on trellised tomatoes. One severe infection was found in greenhouse tomatoes in Massachusetts. Only 1 observation was made in New Hampshire. No appreciable losses were recorded for mosaic in New England.

Streak (virus). One light case was observed in a Massachusetts greenhouse.

PASTINACA SATIVA, PARSNIP

Cercospora pastinacae (C. apii var. pastinacae), leaf spot, was found rather rarely in Rhode Island, Massachusetts, and Vermont. Only in 1 field in Rhode Island and in 1 in Massachusetts was the foliage infection recorded as moderately heavy.

Ramularia pastinacae, leaf blight, was recorded in Massachusetts as less abundant than Cercospora.

PHASEOLUS spp., GARDEN BEANS

Botrytis cinerea, gray mold rot. Isolated cases were found in Massachusetts and Maine, particularly where vine growth was heavy. It caused very little loss, if any.

Colletotrichum lindemuthianum, anthracnose, was found in Connecticut, Massachusetts, Vermont, New Hampshire, and Maine. In Massachusetts it was far less prevalent than usual, especially in the drought area of the eastern part of the State, the only severe case recorded being 1 field with a 90% loss. No appreciable losses were recorded in Connecticut, Vermont, New Hampshire, or Maine.

Fusarium solani f. phaseoli (F. martii var. phaseoli), dry root rot, (Also Fusarium spp. and Rhizoctonia spp., root-rots). In Massachusetts, according to Boyd and Sproston, most plantings early in the season showed above-normal amounts of root rots. A 50% loss in 1 field this year was the heaviest loss ever recorded from F. solani phaseoli in the State.

Isariopsis griseola, angular leaf spot, was observed once, as a trace in a Massachusetts field.

Pseudomonas medicaginis var. phaseolicola, halo blight, was found in Massachusetts, Rhode Island, New Hampshire, and Maine. In Massachusetts the disease occurred in all counties but in much lighter amounts than usual. In Maine the disease seemed more virulent, the systemic phase being quite pronounced, and it probably caused some reduction in yield.

Uromyces phaseoli var. typica (U. appendiculatus), rust, was observed

in Massachusetts and Vermont. Two severe cases occurred in Massachusetts; both on Kentucky Wonder, 50% defoliation being noted in 1 field and 80% loss in the other. Slight infection was noted on a bush variety. In Vermont some losses up to 30% were observed.

Xanthomonas phaseoli, common bacterial blight, appeared in Massachusetts later than usual. Only one heavy field infection was found and that was after harvest. In Rhode Island a single case was noted, with very slight damage if any.

Mosaic (virus) was found in Connecticut, Rhode Island, Massachusetts, Vermont, and Maine, apparently causing less damage this year than in some other seasons. The heaviest infections observed were only slight and damage was negligible.

PISUM SATIVUM, PEA

Erysiphe polygoni, powdery mildew, occurred extensively with slight to moderate damage in Aroostook County, Maine.

Fusarium sp., root rot, was common in Connecticut wherever late peas were planted.

RHEUM RHAPONTICUM, RHUBARB

Phyllosticta straminella, leaf spot, was found in Connecticut, causing very slight damage in 2 locations.

SOJA MAX, SOYBEAN. See with forage crop section

SOLANUM MELONGENA, EGGPLANT

Alternaria solani, leaf spot, was reported by Boyd and Sproston to be generally present but causing very slight damage in Massachusetts.

Phomopsis vexans, leaf spot, fruit rot, occurred in local outbreaks in Connecticut and Rhode Island, causing slight damage as infection was confined mostly to the foliage. Damage this year was less than usual.

Verticillium albo-atrum, wilt, was generally distributed in Connecticut, Rhode Island, and Massachusetts. Losses were slight to moderate in Connecticut and Rhode Island. Severe infections with losses of 50 to 75% were observed in 2 counties in Massachusetts. This disease is considered the principal limiting factor to successful eggplant culture in Massachusetts and southern New England.

Mosaic (virus) was observed to be causing very slight damage in one Connecticut planting.

SOLANUM TUBEROSUM, POTATO

Actinomyces scabies, scab, was probably the most common and serious disease of potatoes in home gardens this year, and in some cases it was also more damaging than usual to the commercial crop. In many cases potatoes were grown in new locations this year, both in victory gardens and in fields, which fact contributed to losses from scab. In New England, scab was apparently of least consequence in Rhode Island. A few severe cases were found in Connecticut, the most serious one being an estimated 5% loss for 200 acres in East Windsor. In Massachusetts, light to moderate damage occurred in many fields in the valley area of Hampshire and Franklin Coun-

ties where the land in past years had been limed for onion or tobacco culture. In a 20-acre limed pasture in Essex County put into potatoes this year the tubers were 100% infected, with a 40 to 50% loss in crop value. In Vermont, scab seemed to be unusually bad with a higher than normal crop loss in places. Some cases of 80 and 90% tuber infection of the deep crater type were found, although, in general, commercial losses were not large. Scab did not appear to be as important in New Hampshire and Maine as in the other States. It was unusual not to find at least traces of scab in northeastern New England, but it is not believed that the disease will account for any appreciable crop loss there.

Chippewa and Green Mountain appear to be the varieties most susceptible to deep scab.

Alternaria solani, early blight. Except for Rhode Island, this disease occurred throughout New England in more widespread and damaging proportions in 1943 than in the average year. General, light to moderate attack was the rule in practically all fields with possible yield reductions up to 5 or 10% in places.

(Corticium solani) see Pellicularia filamentosa.

Corynebacterium sepedonicum, bacterial ring rot, appeared in New England in the most serious proportions ever experienced. Definite occurrence was found in all of the States except Connecticut and New Hampshire. Only one affected field was found in Rhode Island, a 10-acre field that showed about 0.5% rotted tubers at digging time. The owner reported the seed as certified Green Mountain. The disease was found in 3 counties in Massachusetts. One 150-acre planting showed a general but light infection of parts already dug, except one part in which at least 2% of infected tubers were left in the field. This field was planted with No. 2 seed supposedly from a certified crop. In Vermont, H. L. Bailey reported that bacterial ring rot was fairly well distributed over the State. During a limited survey previous to digging time, it was found in 3 fields, and indications were that 2 of the affected fields would contain at least 2 or 3% rotted tubers when dug. In Maine, the disease was rather generally distributed throughout potato-growing sections and created considerable concern among the growers. Of 33 fields in Aroostook County examined during digging, 53% contained ring rot. In about half of the affected fields severity ranged from a trace to 1% of rotted tubers. The greatest amount found in any one field was 10%.

Erwinia phytophthora (E. atroseptica), black leg, appeared to be of little consequence, generally speaking, in southern New England in 1943. In Vermont, according to Bailey, it was unusually widely distributed. In central Maine Bacon stated that 3 fields of the 35-acre class were refused certification because of black leg. Yield reductions in this area ranged from a trace to 12%. In Aroostook County early field inspection indicated that black leg was generally present. Counts ranged from a trace to 20% infected plants in certain fields. At digging time rotted tubers ranged from a trace to 0.5 or 1% in an occasional field.

Fusarium solani var. eumartii, wilt, was found in 2 fields in Massachusetts, one showing 10 to 15% general infection, the other a general but light infection.

Pellicularia filamentosa (Corticium solani), rhizoctonia. According to Boyd and Sproston, greatest damage from rhizoctonia in Massachusetts

took place early in the season. Injury was evidenced in missing and weak hills and light tuber sets due to severing of the stolons. As "rhizoc" was found generally present in light amounts on the tubers in all New England States, it is likely that early-season damage also was general. It was not possible to estimate actual losses, although 5% tuber infection was estimated in Rhode Island.

Phytophthora erythroseptica, pink rot. A single case was observed in Massachusetts in 1943, of a trace of tuber decay, where moderate to severe losses had occurred in recent years.

Phytophthora infestans, late blight, occurred in 1943 only in central and northern New England. None was found in or reported from Connecticut or Rhode Island, probably because of the general drought conditions and warm weather in those States.

In Massachusetts, late blight was first found in the Connecticut Valley on July 27, and it was not until September 1 that it was distributed over the entire State, including the drier regions in the eastern part. Very little damage was caused to either tops or tubers where vines were properly sprayed. In general, owing to infrequent and light rains, tuber decay was negligible except in occasional gardens or low wet fields.

In Vermont, where rain was general throughout the summer, the disease was more severe over the whole State than it has been for years. Preharvest samplings indicated that many fields would contain from 2 to 3% of late blight rot at digging time. In 2 or 3 fields particularly severely attacked, limited samplings indicated 25% of late blight rot by digging time. Northwestern Vermont (Franklin County) was apparently the worst affected by late blight of any area in New England. A few fields were not dug because of combined tuber rots (late blight, bacterial ring rot, black leg), and practically all fields dug were reduced in yield from 35 to 75% by late blight, with an average reduction of about 50%.

In southern New Hampshire late blight generally caused slight to moderate damage to the foliage, but dry weather in early September checked its development and no serious losses were anticipated.

In Maine, the disease appeared late but increased rapidly toward the end of the season prior to digging. Late in the season it was more severe in central Maine than usual and moderately severe in Aroostook County. At digging time a field survey in Aroostook County found 2/3 of the fields to contain blight-affected tubers. Most fields showed from a trace to 2 or 3%, and the most noted was 12%. In a later inspection late blight rot was noted in 60% of the 45 storage houses inspected in Aroostook County; of the affected lots 45% had from a trace to 5% blight rot, 1 lot was 25% affected, another 80%, and another 95%. One grower estimated $80,000 loss resulting from early digging while the vines were still green and freshly infected. A commercial dealer in central Maine estimated his probable loss (including certified and table stock Green Mountain) at 15,000 to 25,000 bushels or 35 to 40% of his total storage. The loss in this case was from late blight followed by bacterial soft rot.

Spongospora subterranea, powdery scab, was found in trace amounts at Presque Isle and Van Buren, Maine.

Leafroll (virus) seemed to occur in about normal proportions in New England in 1943. Following are counts made in Massachusetts, Maine, and

Rhode Island. In Massachusetts, Cobbler, Sebago, and Green Mountain showed from 5 to 15%, Chippewa from 10 to 40%, averaging 25%, Katahdin from a trace to 10%. One grower reported that his Katahdins from No. 2 seed showed from 25 to 80% leaf roll. In Maine, the following counts were made in the most severely affected fields: Ft. Fairfield 30%, Caribou 30%, Amity 54%, Dexter 6% in Green Mountain and 25% in Chippewa. In Rhode Island, counts of 7 fields in the Tiverton-Little Compton area showed infection ranging from 20 to 40%.

Mosaics (virus). Even mild mosaic was so masked in Massachusetts that it was hard to detect. However, an occasional light infection was recorded. In Maine, the only other New England State where mosaic was found, 3 cases were seen; 2 of mild mosaic with 30% infection in 1 field, and the other a light case of rugose mosaic.

Net necrosis (leafroll virus). A single case was observed at Houlton, Maine, where a large field of Green Mountain showed 35% infection.

Purple top (aster-yellows virus). Except for an isolated case in New Hampshire, and several fields of Sebago severely attacked in Rhode Island, purple top seems to have centered very largely in Massachusetts, where it was far more prevalent in 1943 than in most past seasons. It was most pronounced in the Connecticut River Valley, but was also present in most fields visited in other sections after August 1. Plant infections usually ranged from a trace to at least 25%, although one field with nearly 100% was found in Pittsfield. Katahdin generally appeared to be affected more strikingly than other varieties. Yield reductions were very slight even in the late varieties.

Spindle tuber (virus) was not noticeable in the growing fields from certified seed, but was very evident in many fields during harvest. One typical case was found in Massachusetts, in which the yield from home-grown seed was 150 bushels per acre less than in an adjoining field planted with certified seed.

Frost damage. Early in October when the Maine potato growers still had between 50,000 and 75,000 acres to dig, a heavy freeze injured some of the potatoes. In a survey of 28 fields in Aroostook County 90% of the fields showed frost damage, ranging in severity from a trace to 45%, with an average of about 2 or 3%.

Growth cracks (physiogenic). About 30% of the Maine fields showed from a trace to a slight amount.

Hollow heart (physiogenic). About 35% of the Maine fields produced an extraordinarily large proportion of big potatoes ("bulls"; one specimen in Caribou weighed 4 lbs. 9 oz.). Not all large potatoes are hollow, but so many are that such overgrown potatoes are discarded on size under suspicion of being hollow. Bulls were present in many lots from the hill areas of western Massachusetts, and from Vermont and New Hampshire. In Barnstead, New Hampshire, a 6-acre field of Sequoia produced 99% hollow potatoes, and across the road a 4-acre Katahdin field showed at least 70% hollow heart.

Leak (physiogenic). A 5-acre field in Kingston, Rhode Island, showed about 1% of leaky potatoes at harvest time. (This is "sprain" according to Howard).

Stem necrosis (physiogenic) was apparently almost statewide in Connecticut, especially where new ground was used.

Sunburn (physiogenic). Every field visited in Aroostook County, Maine, was affected with sunburn to some extent, some very slightly. In the storage houses sunburn was present in 78% of the 45 lots inspected, severity ranging from a trace to 75%. About 30% was observed in most Katahdins and Sebagos; in other varieties, for the most part, from a trace to 15%. The loss due to sunburn is almost in proportion to the amount present as very little is allowed to pass in grading. 1943 is the worst year for sunburn on record in Aroostook County, owing very largely to the wet season and to shortage of labor for cultivation resulting in incompletely made ridges and exposure of the tubers.

Stem-end browning (cause unknown). In Aroostook County, Maine, 50% of the fields were affected, usually only in trace amounts, but 1 field of Katahdin showed 2%, 1 of Green Mountain 5%, and a second field of Green Mountain 50%.

Tipburn (cause questionable) was noticeable through New England but was definitely most severe in the southern part, especially in Connecticut and Rhode Island.

SPINACIA OLERACEA, SPINACH

Peronospora effusa, downy mildew. Severe infection was observed in 1 large Connecticut field, resulting in 5 to 10% loss. It was also found in 1 field in Massachusetts, causing a very slight loss. Downy mildew was less damaging to fall spinach than usual.

DISEASES OF CEREALS, GRASSES, AND FORAGE CROPS

AGROSTIS CANINA, VELVET BENT GRASS

Corticium fuciforme, pink patch. A single observation was made, at the Kingston, Rhode Island experimental plots where it was causing only a moderate amount of damage.

Sclerotinia homoeocarpa, dollar spot, was seen but once, at the Kingston, Rhode Island experimental plots. It was causing a moderate amount of damage.

AVENA SATIVA, OATS

Puccinia coronata, crown rust, was observed in several locations in Vermont and Maine. In many cases damage was severe, as evidenced by the shriveling of the grain.

Puccinia graminis var. avenae, stem rust, was observed as local outbreaks in Vermont and Maine. The presence of the common barberry (Berberis vulgaris) was reported near one severely damaged field in Brookfield, Vermont.

Ustilago avenae, loose smut, was found in 2 locations in Maine. Damage was slight to moderate.

Ustilago kolleri (U. levis), covered smut. Local occurrences in Maine caused only a slight loss.

HORDEUM VULGARE, BARLEY

Puccinia graminis, stem rust, was found in Newport and Littleton, Maine, where it was generally prevalent but causing very slight to slight damage.

Ustilago jensenii (U. hordei), covered smut, was found in 1 field in Caribou, Maine, where it was present in very small amounts.

Ustilago nuda, loose smut, also occurred in small quantities in the field at Caribou.

MEDICAGO SATIVA, ALFALFA

Pseudopeziza medicaginis, leaf spot, was observed once, in Maine, causing very slight damage.

Yellowing due to boron deficiency (diagnosed at the Storrs Station, Connecticut), was rather prevalent throughout central Connecticut. Considerable yellowing and some stunting of the plants was evident.

SOJA MAX, SOYBEAN

Mosaic (virus), with crinkle to rugose symptoms, was present on 24 varieties of edible soybeans in the Kingston, Rhode Island test plots. Infection ranged from 20 to 90% and was accompanied by marked stunting of the plants in certain cases. There was some reduction in yield. Mosaic was present in 1 field planting of edible soybeans in Connecticut and in several home gardens in Massachusetts, causing some severe stunting and yield reduction. Mosaic was also found in field soybeans in Maine, causing very slight stunting.

TRIFOLIUM spp., CLOVER

Erysiphe polygoni, powdery mildew, was generally distributed over New England; causing an unknown amount of loss.

Pseudopeziza trifolii, leaf spot, was found on red clover in New Hampshire and Maine; it was severe enough to cause damage only at 1 location in New Hampshire.

Uromyces trifolii, rust, was found causing slight to moderate damage at several places in Connecticut, Rhode Island, and Maine.

TRITICUM AESTIVUM, WHEAT

Gibberella zeae (G. saubinetii), scab, was noted in 1 field in Aroostook County, Maine, where it was generally distributed but resulted in only very slight to slight damage.

Puccinia rubigo-vera tritici (P. triticina), leaf rust, was general and causing slight damage in 1 field in Aroostook County.

Septoria nodorum, glume blotch, was general and causing slight damage in 1 field in Aroostook County.

ZEA MAYS, CORN

Bacterium stewartii (Phytomonas stewartii), bacterial wilt, was reported in 1 Connecticut planting..

Helminthosporium turcicum, leaf blight. Boyd and Sproston report only traces to very light infections generally in Massachusetts in 1943, contrasted with the severe outbreak of the preceding year in that State.

Ustilago maydis (U. zeae), smut, was much more severe than usual in southern New England in 1943, but was almost nonexistent in northern New

England. In Connecticut, damage was slight to moderate. In Massachusetts, smut was particularly bad in the early and second plantings in all counties. Boyd and Sproston reported 1 field observed in Middlesex County on July 28 with 30% of the plants infected and 20% ear infection, which was the heaviest loss from smut ever reported in the State. In Rhode Island, smut was widespread on sweet corn, popcorn, and field corn. Howard estimates a 5% loss of sweet corn ears in the worst attack of the last 5 years.

DISEASES OF FRUIT CROPS

AMYGDALUS PERSICA, PEACH

Monilinia fructicola (Sclerotinia fructicola), brown rot, was found only in Rhode Island, in 1 orchard. The grower reported a considerable amount of brown rot since, because of the small crop, the trees were not well sprayed. This orchardist, at Portsmouth, produced the only crop of peaches known to the writer in New England in 1943. He harvested 500 bushels.

Xanthomonas pruni, bacterial spot, was found in Connecticut, Massachusetts, and New Hampshire. Where it occurred, infection was fairly heavy and slight to moderate damage to the foliage resulted.

Winter injury. The severe winter of 1942-43 killed the peach fruit buds in New England.

FRAGARIA, STRAWBERRY

Mycosphaerella fragariae, leaf spot, was recorded in Connecticut, Rhode Island, Massachusetts, and Maine. Only in Portsmouth, Rhode Island, was there sufficient defoliation to cause some probable damage.

Root rot (cause undetermined) caused slight damage in 1 field in Bristol County, Massachusetts, and the loss of half the crop in the first bearing year of a 7-acre field in Hamden, Connecticut.

MALUS SYLVESTRIS, APPLE

Erwinia amylovora, fireblight, was found in Massachusetts and Maine. Only in South Amherst was there as much as slight damage in Massachusetts. In Maine, considerable damage was evident in the Acton area.

Glomerella cingulata, bitter rot. Two cases were observed in Massachusetts. In 1 instance the disease caused the loss of 1 tree which was removed in the fall; in the other case rot caused 50% loss of Rhode Island Greening in the orchard.

Gymnosporangium clavipes, quince rust, was observed in Massachusetts and Maine. Damage to Red Delicious and Golden Delicious in Maine was slight to moderate. In Massachusetts, both quince and hawthorn (*G. globosum*) rusts were less damaging than usual.

Gymnosporangium juniperi-virginianae, apple rust, was found in all of the New England States. Foliage infection was severe in some places but very little fruit infection was noted even on Wealthy. The disease was reported to be less prevalent than usual in Rhode Island.

Helminthosporium papulosum, black pox, was observed in 1 orchard each in Bristol and Plymouth Counties, Massachusetts. Leaf spots were numerous, and fruit spots were beginning to show on Northern Spy by the second week in September.

Mycosphaerella pomi (Cylindrosporium pomi), fruit spot (Brooks spot), was reported by G. A. Gries to be present in Connecticut.

Neofabraea malicorticis, anthracnose, was observed once in Maine; no damage was noted.

Physalospora obtusa (P. malorum), black rot, frog-eye, was found in Connecticut, Rhode Island, Massachusetts, New Hampshire, and Maine. Infection of the leaves varied from light to heavy. Fruit infection was not uncommon even in some well-sprayed orchards. Branch cankers were common following fireblight in 1 Massachusetts location.

Venturia inaequalis, scab. 1943 was one of the most favorable seasons on record for the development of apple scab in New England. Commercial losses in well-sprayed orchards in Rhode Island and Connecticut ranged from a trace to 40%; on the whole, scab accounted for from 15 to 20% of the fruits failing to make the No. 1 grade as they otherwise would. In Massachusetts, commercial losses in McIntosh ranged from a trace to 25% in sprayed orchards. Scab was present in the southern parts of Vermont, New Hampshire, and Maine in about the same proportions as in southern New England. The most seriously affected local area in New England seemed to be through Hero and Grand Isle in northwestern Vermont, where, in spite of excessive spraying,no protective covering could be maintained, owing to the heavy rains. The average fruit infection for the area was 25 to 30%. Throughout New England, losses in unsprayed orchards ranged from 50 to 100%, and defoliation was practically complete in many McIntosh orchards by September 15.

Infectious chlorosis or mosaic (virus). One local case was observed in Connecticut, where the disease was severe enough to cause the partial defoliation of several acres of trees.

Bitter pit (physiogenic). In Massachusetts losses were about normal, with greatest damage to Baldwin, Northern Spy, and King, slight losses on Cortland, and traces on McIntosh. The disease was very severe in 1 young Baldwin orchard in Rhode Island.

Fruit russet (physiogenic). Some rather severe cases were recorded in Connecticut, Massachusetts, and New Hampshire, on Baldwin and Delicious in particular.

Magnesium deficiency leaf scorch developed rather extensively in Massachusetts and southern New Hampshire, although later in the season than usual. On severely affected trees the fruits were badly stunted and dropped prematurely.

PYRUS COMMUNIS, PEAR

Fabraea maculata, leaf blight. A single case was observed in Rhode Island, of slight to moderate damage.

RUBUS sp., RASPBERRY

Elsinoë veneta, anthracnose, was found in 1 locality in Rhode Island and 1 in New Hampshire; in both cases it was general in the plantings, causing slight and moderate damage, respectively.

Mosaic (virus) was observed causing severe damage in 1 Rhode Island planting which has since been removed, and slight damage in 1 Maine planting.

VACCINIUM sp., BLUEBERRY

Microsphaera alni var. vaccinii, powdery mildew, occurred locally in 1 field in Columbia, Maine, causing slight damage.

Pucciniastrum goeppertianum (Calyptospora columnaris), rust witches-broom, occurred locally with slight damage in 1 field in Columbia, Maine.

Pucciniastrum myrtilli, leaf rust, was general and caused severe damage in 7 fields in Franklin and 2 fields in Columbia, Maine.

VITIS sp., GRAPE

Guignardia bidwellii, black rot. Single occurrences with no loss resulting were found in Connecticut, Rhode Island, and New Hampshire.

Plasmopara viticola, downy mildew, was present on most vines that had not been killed by late-season frosts in Massachusetts. There were no losses in yield.

DISEASES OF MISCELLANEOUS PLANTS

AESCULUS HIPPOCASTANUM, HORSECHESTNUT

Guignardia aesculi, leaf blotch, was prevalent throughout most of New England. Defoliation was most serious in Connecticut and Rhode Island. Severity gradually diminished toward northern New England.

CATALPA sp., CATALPA

Alternaria catalpae (Macrosporium catalpae), leaf spot, was generally prevalent in the New Haven, Connecticut, area where it was causing slight to moderate leaf spotting.

FRAXINUS spp., ASH

Puccinia peridermiospora (P. fraxinata), rust, caused severe defoliation of trees in coastal regions.

HELIANTHUS ANNUUS, SUNFLOWER

Erysiphe cichoracearum, powdery mildew, was generally distributed in 1 small planting in Hamden, Connecticut, causing no appreciable damage.

Puccinia helianthi (P. helianthi-mollis), rust, occurred in the same planting in Hamden; damage was very slight, if any.

NICOTIANA TABACUM, TOBACCO

Rhizoctonia sp., sore shin, was found to be general in fields surveyed in the Connecticut River Valley of Massachusetts, but most infections were light. Severe infection was found in only 1 field, where 35 to 40% of the plants were affected and the probable loss was 25%.

Mosaic (virus) was generally present in slight to moderate amounts in the Connecticut River Valley of Massachusetts. An occasional field contained 20 to 30% of the plants infected.

PRUNUS VIRGINIANA, CHOKE CHERRY
Dibotryon morbosum (Plowrightia morbosa), black knot, was present locally and causing slight damage in New Hampshire, Rhode Island, and Maine.

SONCHUS ARVENSIS, SOW THISTLE
Yellows (aster-yellows virus), was generally prevalent in Portland, Maine.

SUMMARY OF PLANT DISEASE SURVEYS IN NEW YORK IN 1943

Leon J. Tyler

The following is a brief summary of observations made, concerning plant pathogens, in New York State during the period August 1 to November 15, 1943.

PATHOGENS CAUSING DISEASES OF VEGETABLE CROPS

ALLIUM CEPA, ONION
Colletotrichum circinans was noted in central New York but was apparently not important this year.
Peronospora destructor was noted in central New York counties.
Urocystis cepulae was observed only in Oswego County fields (muckland). Up to 25% of the bulbs were diseased in some fields sown without treatment.

APIUM GRAVEOLENS var. DULCE, CELERY
Cercospora apii was generally distributed but the incidence in the fields visited was low.
Erwinia carotovora was seen only in 1 Oswego County field where about 2% of the plants were destroyed.
Septoria apii was found in almost every celery field visited in upstate New York. It was very destructive in some Oswego County fields on muckland.

ASPARAGUS OFFICINALIS, ASPARAGUS
Puccinia asparagi was general in distribution but prevalence and severity were very low.

BETA VULGARIS, BEET
Cercospora beticola was everywhere prevalent in garden beets and in many localities the organism was very destructive.

BRASSICA OLERACEA var. CAPITATA, CABBAGE
Erwinia carotovora was generally distributed in cabbage-growing areas, causing a soft rot of the cabbage head top. One field in Nassau County showed 15% rot of this type.

Fusarium oxysporum f. conglutinans (F. conglutinans) was observed in Ontario, Wayne, and Monroe Counties; it was destructive in only 1 of the fields visited.

Peronospora parasitica was general in up-state cabbage fields and home gardens, but little damage was done owing to lateness of its attack.

Phoma lingam was observed in widely separated counties. It was especially destructive in Cortland County where from 30 to 40% loss occurred in 60 acres set with plants grown from untreated seed.

Plasmodiophora brassicae was general in up-state counties where cabbage is grown. Prevalence usually was not more than 1 to 2%, but in 1 Cortland County field 50% of the plants were attacked.

Xanthomonas campestris was general wherever cabbage was grown but prevalence was very low.

CAPSICUM FRUTESCENS, PEPPER

Gloeosporium piperatum was especially destructive in 1 Dutchess County field.

Verticillium alboatrum was widely distributed but appeared unimportant in 1943.

Virus: tobacco mosaic virus, Marmor tabaci var. vulgare, was generally distributed but causing little damage.

CUCUMIS MELO, CANTALOUP

Cladosporium cucumerinum was noted once in Nassau County.

Colletotrichum lagenarium was noted infrequently in Nassau County.

Virus: cucumber mosaic virus, Marmor cucumeris var. vulgare, was noted infrequently in Nassau County.

CUCUMIS SATIVUS, CUCUMBER

Cladosporium cucumerinum was noted in central New York gardens and in Long Island fields.

Colletotrichum lagenarium was widely distributed but seen infrequently.

Erysiphe cichoracearum was general in distribution but caused little damage.

Erwinia tracheiphila was present in all fields and gardens visited, causing much destruction.

Virus: cucumber mosaic virus, Marmor cucumeris var. vulgare, was destructive in some Nassau County fields.

CUCURBITA MAXIMA, SQUASH, and CUCURBITA PEPO var. CONDENSA, SUMMER SQUASH

Erysiphe cichoracearum was widespread on winter squash.

Rhizopus nigricans was generally distributed. Considerable destruction due to this organism was noted in 1 Nassau County field.

Virus: cucumber mosaic virus, Marmor cucumeris var. vulgare, was generally distributed but appeared to have caused little damage.

CUCURBITA PEPO, PUMPKIN

Erysiphe cichoracearum was generally distributed in Nassau County and in up-state home gardens.

DAUCUS CAROTA, var. SATIVA, CARROT

Alternaria carotae (Macrosporium carotae) was observed causing slight leaf blight in almost all commercial fields and home gardens, and was frequently associated with Cercospora.

Cercospora carotae (C. apii var. carotae) was almost always present in carrot fields and gardens, causing slight damage.

LACTUCA SATIVA var. LONGIFOLIA, ROMAINE

Virus: aster-yellows virus, Chlorogenus callistephi var. vulgaris. Aster yellows rendered a half-acre field of romaine on Oswego County muck entirely worthless.

LYCOPERSICON ESCULENTUM, TOMATO

Alternaria solani was generally distributed over the State. Considerable damage was done in victory gardens and in commercial fields. In Wayne County fields the loss was as much as 1 to 5 tons per acre. In many fields the plants were completely defoliated at the height of the picking season. A considerable amount of fruit was culled because of fruit lesions.

Alternaria tomato was found only in Suffolk County causing nail-head spot of the fruit.

Cladosporium fulvum was generally distributed in the tomato-growing areas. Much destruction resulted in some Wayne and Ontario County fields.

Colletotrichum phomoides was general over the State. It was very destructive in a few fields observed in Niagara County and in 1 Dutchess County field.

Phytophthora infestans was general throughout upstate New York. Up to 25% of the fruits were attacked in some unsprayed Ontario County fields.

Septoria lycopersici was general over the State, but severe only in Genesee and Niagara Counties.

Virus: cucumber mosaic virus, Marmor cucumeris var. vulgare, was rather widely distributed but was rare in commercial fields, being found more frequently in home gardens.

Tobacco mosaic virus, Marmor tabaci var. vulgare, was general but damage was moderate.

Double streak, mixture of tobacco mosaic virus and some potato mottle virus, Marmor dubium var. vulgare, was general but usually low in prevalence.

PASTINACA SATIVA, PARSNIP

Cercospora pastinacae was general in central New York home gardens.

PHASEOLUS LUNATUS, LIMA BEAN

Diaporthe phaseolorum was noticed only in central New York counties where damage was insignificant.

Phytophthora phaseoli was observed in 1 field in Suffolk County. Weather was unfavorable for the development of an epiphytotic.

Pseudomonas syringae was general over the State but low in prevalence and severity.

PHASEOLUS VULGARIS, BEAN

Colletotrichum lindemuthianum was generally distributed over up-state New York but was destructive only in Madison, Oneida, and Genesee Counties.

Fusarium spp. were found causing dry root rot of marrow bean, pea bean, Red Kidney, and snap bean throughout central and northwestern New York. Usually the disease was found to be more destructive to pea bean than to other kinds, especially in Livingston, Monroe, and Orleans Counties where infection ran up to 50% in some fields. Thirty percent infection was recorded on Red Kidney beans in the same area.

Pseudomonas medicaginis var. phaseolicola occurred generally on snap beans and dry shell beans in the State, but field prevalence and severity were usually very slight.

Xanthomonas phaseoli was generally prevalent in all sections of New York State and caused much damage in the northwestern and central parts. It was more destructive than during the past 2 years.

Bean virus 1, Marmor phaseoli, was present wherever beans were grown. Prevalence usually varied from a trace to 12%. From 60 to 80% infection was found in Niagara County, where it was especially destructive to pea beans and French Horticultural beans.

Bean yellow-mosaic virus was generally distributed wherever beans were grown.

RHEUM RHAPONTICUM, RHUBARB

Phyllosticta straminella was generally prevalent on rhubarb but did not appear destructive to the plants examined.

SOJA MAX. See with forage crops section.

SOLANUM MELONGENA, EGGPLANT

Alternaria solani was found causing leaf lesions on eggplant in many gardens but did very little damage.

Phomopsis vexans was prevalent in central New York. In some home gardens up to 30% of the fruit was infected.

Verticillium albo-atrum was generally distributed wherever eggplants were grown. Up to 50% infection was noted in some Dutchess County fields.

SOLANUM TUBEROSUM, POTATO

Alternaria solani was prevalent in all up-state potato-growing areas. Destructive attacks were reported on Houma potatoes in Oswego County and in some Onondaga County fields.

Corynebacterium sepedonicum is established in 24 of 62 New York counties. Its prevalence is known to have been intensified by the introduction and use of out-of-state "selected" seed. In 1 Steuben County commercial field of Katahdin up to 20% of the tubers were rotted.

Ditylenchus dipsaci (Anguillulina dipsaci) was observed only near Hicksville on Long Island.

Erwinia phytophthora was found frequently in certain counties where out-of-state seed was planted.

Fusarium solani f. eumartii (F. solani var. eumartii) was generally distributed in up-state potatoes. Four out of 25 Genesee County fields exhibited from 1 to 15% of the plants attacked.

Heterodera marioni was observed in Nassau County on Long Island.

Phytophthora infestans was widely distributed over the State by August 16 and destructive attacks were noted in muckland potatoes by August 21. It became destructive in many fields of upland potatoes and to home gardens by September 16. The varieties Sequoia and Sebago appeared to be less destructively affected than Katahdin and Rural. In Steuben County, tubers seen in the field and in warehouse bins exhibited from none to 5% blight; usually such tuber lots showed 1 to 2%. Long Island potatoes were mostly mature before the organism became destructive.

Virus? (calico disease). A disease exhibiting symptoms at least similar to those of the calico disease was observed in a few fields in Wayne, Ontario, Orleans, Monroe, and Erie Counties. Not more than 1 or 2 plants were found during the brief examination of any one field.

SPINACIA OLERACEA, SPINACH

Pythium debaryanum, damping-off, was everywhere prevalent in spinach, doubtless because of unusually favorable weather for the disease.

CEREALS, GRASSES, AND FORAGE PLANTS

AVENA SATIVA, OATS

Puccinia coronata was generally prevalent and destructive in central and northwestern counties.

Puccinia graminis var. avenae was generally distributed in very light amounts in Ontario, Livingston, Wyoming, and Genesee County fields.

HORDEUM VULGARE, BARLEY

Puccinia anomala was generally distributed in up-state New York and was destructive in late barley fields.

Puccinia graminis var. hordei was generally distributed in western counties and was destructive to late barley.

MEDICAGO SATIVA, ALFALFA

Ascochyta imperfecta was general in central New York.

Corynebacterium insidiosum is general over the State wherever alfalfa is grown. As high as 50% infection has been seen in some fields and some of these were 2-year-old stands.

Pseudopeziza medicaginis was present in almost all fields. It was found to be causing severe leaf shedding in Cayuga and Chenango Counties.

Pseudoplea trifolii was noticed only in Madison County.

Stagonospora meliloti was generally distributed but causing very little damage.

Stemphylium sarcinaeforme (Macrosporium sarcinaeforme) was everywhere prevalent but causing very little damage

SOJA MAX, SOYBEAN

Alternaria sp. (A. atrans ?) was general in distribution, especially in victory garden soybeans.

Cercospora sojina was found near Marathon in Cortland County. Apparently this is the first report of its occurrence in New York State.

Peronospora manshurica was generally distributed in central and western New York. Destructive occurrence was noted on the variety Seneca in Tompkins County.

Pseudomonas glycinea was widespread and destructive.

Virus: pea virus 1, *Marmor pisi*, was generally distributed wherever soybeans are grown. Usually not more than 1% of the plants are affected but sometimes as high as 15% infection has been found.

TRIFOLIUM PRATENSE, RED CLOVER

Cymadothea trifolii (Dothidella trifolii) was observed in central New York. Moderately severe infection was noted on 25% of the plants in some Cayuga County fields.

Erysiphe polygoni was present in almost every red clover field and was causing much destruction in many.

Pseudopeziza trifolii was generally distributed over the State. It causes much shedding of leaves in central New York Counties.

Stemphylium sarcinaeforme (Macrosporium sarcinaeforme) was general in distribution but was causing little damage.

Uromyces trifolii was general in red clover fields. In central New York some fields were destructively affected.

Virus: common pea-mosaic virus, *Marmor leguminosarum*, was general in distribution and very severe in many fields.

ZEA MAYS, CORN

Diplodia zeae, ear rot, was generally distributed in field corn and caused a loss of probably 2%.

Fusarium moniliforme, ear rot, was generally distributed in field corn but caused little damage.

Gibberella zeae (G. saubinetii), ear rot, was general on field corn but damage was insignificant.

Ustilago maydis (U. zeae), ear smut, was generally distributed but everywhere low in prevalence and the loss did not exceed 0.5% for the State.

FRUIT CROPS

AMYGDALUS PERSICA, PEACH

Cladosporium carpophilum was generally distributed in New York peach areas but inconspicuous because of failure of the peach fruit crop.

Monilinia fructicola was generally distributed in peach-growing areas, but because of the almost complete failure of the crop due to weather conditions the pathogen was not particularly evident in orchards visited.

Taphrina deformans (Exoascus deformans) was noted in a few orchards along Lake Ontario in northwestern New York.

Virus: X-disease virus, *Marmor lacerans* (yellow-red virosis, X-disease). In the Hudson Valley peach area many orchards located near choke cherry exhibit up to 50 to 75% diseased trees.

MALUS SYLVESTRIS, APPLE

Erwinia amylovora was general but everywhere low in prevalence and severity.

Gymnosporangium clavipes (G. germinale)was generally distributed in eastern New York apple areas and was more destructive in 1943 than during the past 5 years. In sprayed trees fruit infection varies from 2 to 10%.

Gymnosporangium juniperi-virginianae was general in the Hudson Valley area, with more fruit infection this year than last. Up to 15% of the fruit was destroyed on unsprayed trees.

Physalospora obtusa was found in almost all orchards but was causing little loss.

Venturia inaequalis was generally distributed and everywhere destructive. The crop in the Hudson Valley was reduced by 10%. In Clinton and Essex Counties, the crop of U. S. Fancy No. 1 apples was reduced 20 to 25%.

PRUNUS AVIUM, SWEET CHERRY, AND P. CERASUS, SOUR CHERRY

Coccomyces hiemalis was generally distributed and destructive in all sweet and sour cherry-growing regions. Complete defoliation resulted from the leaf spot as early as August 25 in the Hudson Valley area.

PYRUS COMMUNIS, PEAR

Erwinia amylovora was general in distribution and considerable destruction was noted in some Hudson Valley orchards.

Gloeodes pomigena was found to be generally distributed in the Hudson Valley and in some unsprayed orchards it completely ruined most of the fruit.

RIBES sp., GOOSEBERRY

Mycosphaerella grossulariae was prevalent and destructive.

Sphaerotheca mors-uvae was prevalent and very destructive in Ontario County.

RIBES SATIVUM, RED CURRANT

Pseudopeziza ribis was prevalent and destructive in Ontario County plantings.

RUBUS spp., BLACKBERRY

Elsinoë veneta (Gloeosporium venetum) was general and very destructive in some western New York plantings.

Septoria rubi was general but not destructive.

RUBUS OCCIDENTALIS, BLACK RASPBERRY, and RUBUS IDAEUS, RED RASPBERRY

Agrobacterium tumefaciens was general in distribution but was severe in only one planting visited.

Didymella applanata was generally distributed but did not appear to be especially destructive in 1943.

Elsinoë veneta (Gloeosporium venetum) was prevalent in Ontario County plantings but not destructive.

Gymnoconia peckiana (G. interstitialis) was noted in Ontario County plantings but was not destructive this year.

Septoria rubi (probably Sphaerulina rubi) was generally distributed but did not occur destructively.

Sphaerotheca humuli was especially prevalent on and destructive to the variety Latham.

Verticillium albo-atrum was seen infrequently in Ontario County plantings.

VACCINIUM CORYMBOSUM, BLUEBERRY

Microsphaera alni var. vaccinii. The variety Pioneer appears to be more susceptible than some other varieties in Oswego County plantings.

Phomopsis spp. Pioneer exhibited more Phomopsis gall than did other varieties.

Virus: blueberry stunt virus. Blueberry stunt is becoming very prevalent in Oswego County plantings. Pioneer appears to be more susceptible than Rubel, Jersey Concord, and Rancocas.

VITIS spp., GRAPE

Guignardia bidwellii was generally distributed wherever grapes were grown but was causing appreciable loss only in the variety Duchess.

Plasmopara viticola was generally distributed in Ontario, Steuben, and Yates County vineyards, with much damage being done to the Delaware variety. It was unimportant in the Hudson Valley grape region this year.

Uncinula necator was very destructive in some vineyards in Steuben, Ontario, and Yates Counties.

SPECIAL CROPS

HUMULUS LUPULUS, HOP

Colletotrichum humuli, anthracnose, was general in the hop-growing area. A 1-acre hop yard in Oneida County sustained a 25% loss.

Fumago vagans, sooty mold, was generally distributed. About 1% of the entire crop was destroyed by this pathogen.

Pseudoperonospora humuli, downy mildew, was general in the New York hop-growing area. Attacks during May were destructive because of delay in operations due to the wet weather. A considerable loss from this disease was sustained on about 150 acres.

Sphaerotheca humuli, powdery mildew, was epiphytotic in Franklin County but losses were low.

Virus: virus-like disease of hops. From 10 to 30% of the hop plants on 16 acres in Oneida County were destructively affected.

PLANT DISEASE SURVEYS IN PENNSYLVANIA, 1943

Leon J. Tyler

Following is a brief summary of observations made concerning plant diseases in Pennsylvania during the period from August 1 to November 19, 1943.

VEGETABLE CROPS

ABELMOSCHUS ESCULENTUS, OKRA. Macrosporium sp. was causing leaf spot in Montgomery and Susquehanna County gardens.

ALLIUM CEPA, ONION. Stemphylium botryosum (Macrosporium parasiticum) was observed in trace amounts in Wyoming and Susquehanna Counties, causing leaf break of the onion tops.

APIUM GRAVEOLENS, CELERY. Cercospora apii was observed in amounts ranging from a trace on 25% of the plants in one Cumberland County field to moderately severe on all plants in one Berks County field. Erwinia carotovora was severe in one large Berks County field, and slight in one Lancaster County garden. Infection by Septoria apii ranged from trace to light on most of the plants seen in Cumberland County to severe on all plants seen in Columbia County. Virus yellows affected 3% of the plants in one Luzerne County field.

ASPARAGUS OFFICINALIS, ASPARAGUS. Fusarium spp. occurred in very slight amounts in one Bucks County field. Traces of Puccinia asparagi were noted in a Bucks County commercial field.

BETA VULGARIS, BEET. Cercospora beticola occurred in light to moderate amounts in Bucks and Dauphin County fields and gardens. Boron deficiency was very severe in 2 Bucks County fields.

BRASSICA OLERACEA var. BOTRYTIS, CAULIFLOWER. Alternaria circinans (A. brassicae) was noted in Montgomery County, in trace amounts.

BRASSICA OLERACEA var. BOTRYTIS, BROCCOLI. Alternaria spp. occurred in slight amounts on most of the plants seen in a few Luzerne County fields. A trace of Phoma lingam was observed in one Luzerne County field.

BRASSICA OLERACEA var. CAPITATA, CABBAGE. Alternaria spp. were causing leaf spot in Columbia and Montgomery Counties but the infection observed was very slight. Phoma lingam occurred in traces in some Luzerne County fields. Plasmodiophora brassicae was noted in trace amounts wherever cabbage was examined. Xanthomonas campestris was noted in almost every cabbage field entered but infection was never more than a trace.

CAPSICUM FRUTESCENS, PEPPER. Fusarium sp. was noted causing a trace of wilt in one Luzerne County field. Gloeosporium piperatum, usually followed by Alternaria sp., caused severe fruit spot in one Luzerne County field.

Mosaic caused by the tobacco mosaic virus was observed in Berks and Columbia Counties, infection ranging from a trace to 3%. Slight infections of spotted wilt were noted in one Luzerne County field.

Sunscald followed by Alternaria spp. was prevalent in almost every planting of peppers seen in Luzerne, Susquehanna, and Wyoming Counties. Usually from 5 to 25% of the fruits were destroyed.

CUCUMIS MELO, CANTALOUP. Alternaria cucumerina (Macrosporium sp.) was causing light to moderate leaf spotting in Bucks County fields. Very slight infection with Colletotrichum lagenarium was observed in a Bucks County field. Light infection by Erysiphe cichoracearum occurred on a few plants noted in Bucks County. Pseudomonas lachrymans occurred in very slight infections on a few plants in one Montgomery County field.

CUCUMIS SATIVUS, CUCUMBER. A trace of Colletotrichum lagenarium was noted in one Bucks County field. Erwinia tracheiphila was very generally distributed at least in the central, southeastern, eastern, and northeastern parts of the State, infection ranging from a trace to moderately severe. Erysiphe cichoracearum was noted in one Montgomery County field.

CUCURBITA MAXIMA, SQUASH. Light infection by Colletotrichum lagenarium was observed in Bucks County. Mycosphaerella citrullina was causing a destructive fruit spot of white squash in a Bucks County field. Moderate fruit infection by Rhizopus nigricans was observed in Luzerne County. Occasional plants affected by the cucumber mosaic virus were observed in a Luzerne County planting.

CUCURBITA PEPO, SQUASH. Phyllosticta sp. was causing moderate leaf spotting on 25% of the plants in a Berks County field.

DAUCUS CAROTA, CARROT. Cercospora carotae and Alternaria carotae, frequently associated, were found causing slight to moderate leaf spotting on a trace to 10% of the plants in Bucks, Columbia, and Montgomery Counties. Heterodera marioni was found causing slight damage in one large Bucks County field. A trace of Rhizopus nigricans was found in one Bucks County field.

LACTUCA SATIVA, LETTUCE. A trace of leaf spot caused by Septoria sp. was found in Montgomery County.

LYCOPERSICON ESCULENTUM, TOMATO. Alternaria solani was prevalent wherever tomatoes were grown. Infection varied from a trace to moderate on most plants in the central, southeastern, and eastern counties. Severe infection was noted in Montgomery County.

A trace of Alternaria tomato was noted on a few plants in Lancaster and Franklin Counties.

Cladosporium fulvum was noted on greenhouse plants and was severe in one greenhouse, in Columbia County. On outdoors tomatoes it was severe in 2 fields in Lancaster County, and a trace was noted in one garden in Adams County.

Traces to light amounts of Colletotrichum phomoides were observed in all central, southeastern, and southern counties.

Septoria lycopersici was generally distributed in central and southeastern counties but in most cases infection varied from a trace to only slight on most plants.

Xanthomonas vesicatoria was observed in Bucks, Lancaster, and Franklin Counties. In one Franklin County field 90% of the fruits showed spots due to this organism. Only traces were observed in the other 2 counties.

The tobacco mosaic virus was general in distribution but usually low in prevalence.

Sunscald (physiogenic) was generally prevalent in central and southeastern counties. Occasionally it was very severe where early blight was severe.

Fruit pox (undetermined origin) was noted in Cumberland County but appeared to be of slight importance.

PASTINACA SATIVA, PARSNIP. Severe infection by Cercospora pastinacae was observed on 75% of the plants in one Cumberland County planting.

PHASEOLUS LUNATUS, LIMA BEAN. Alternaria sp. caused large circular leaf lesions and was severe in one Snyder County victory garden. Pseudomonas syringae was generally distributed in fields visited in Luzerne, Berks, and Columbia County, infection ranging from light to moderately severe on all plants.

PHASEOLUS VULGARIS, BEAN. Colletotrichum lindemuthianum, usually in slight infections, was observed in victory gardens in central and northeastern counties.

A trace of Fusarium spp. causing dry root rot was noted in Bucks County.

Pseudomonas medicaginis var. phaseolicola was widely distributed, but not more than a trace was observed in fields examined.

Rhizoctonia solani was noted in Bucks County but appeared to be unimportant.

Uromyces phaseoli var. typica (U. appendiculatus) was widely distributed but did not appear to be destructive in 1943.

Xanthomonas phaseoli was widely distributed in the State, infection varying from a trace to moderately severe on 25 to 100% of the plants in fields examined.

Bean mosaic (bean virus 1) was widely distributed. In Dauphin and Bucks Counties infection varied from 5 to 15%.

Yellow mosaic was noticed in gardens and fields throughout the central and northeastern counties.

RHEUM RHAPONTICUM, RHUBARB. Phyllosticta straminella was causing a trace of leaf spot on all plants in a Lebanon County planting.

SOJA MAX. See with forage crops section.

SOLANUM MELONGENA, EGGPLANT. A trace of Alternaria solani occurred on all plants seen in Columbia and Berks Counties. Phomopsis vexans caused slight leaf spotting in one Luzerne County field and severe fruit spot in a field in Bucks County. Verticillium albo-atrum was generally prevalent wherever eggplant was seen.

SOLANUM TUBEROSUM, POTATO. Actinomyces scabies was everywhere prevalent but was destructive in only a few fields.

Alternaria solani was widely distributed but no destructive attacks were found.

(Corticium solani) see Pellicularia filamentosa

Corynebacterium sepedonicum caused widespread destruction at least in Potter and Warren Counties. The percentage of tubers attacked usually ranged from 1 to 6 but one field was seen in which 25 to 50% of the tubers were diseased. About 30% of the fields visited exhibited some ring rot.

A trace of Erwinia phytophthora was noted in Lackawanna County.

Fusarium solani f. eumartii (F. solani var. eumartii) was widely distributed in potato-growing areas. A few fields in Lackawanna County exhibited from 1 to 3% infection. In Warren County from 0.5 to 1% of the plants were attacked in fields visited.

Pellicularia filamentosa (Corticium solani) was widespread but not particularly destructive.

Phytophthora infestans was generally distributed in potato-growing areas. From tuber counts in Potter and Warren Counties at digging time, it was found that from 1 to 2% of the tubers in some fields exhibited blight lesions.

Of the virus diseases, leaf roll was apparently generally distributed. Counts in 3 fields in Lackawanna County indicated from 1 to 3% of the plants attacked. A bare trace of spindle tuber was seen in Potter and Warren Counties. Yellow dwarf was widely distributed but usually not more than 1% of the plants were attacked. Giant hill and mouse ear were observed in Lackawanna County.

CEREALS AND FORAGE CROPS

MEDICAGO SATIVA, ALFALFA. *Ascochyta imperfecta* was widely distributed. In some Northampton County fields as high as 50% of the plants were severely diseased.

Corynebacterium insidiosum was widely distributed, as shown by its occurrence in at least 25 counties and in 79 of 122 fields examined. Infection ranged from a trace to 50% of the plants. A yield reduction of 20% would appear to be a conservative estimate of the loss sustained.

Pseudopeziza medicaginis was widely distributed all over Pennsylvania. Infection ranged from a trace on a few plants to moderate on most of the plants. The heaviest infections were noted in eastern and southeastern counties.

SOJA MAX, SOYBEAN. *Alternaria atrans* was observed once, in a Snyder County victory garden.

Fusarium sp. was isolated from diseased roots of plants taken from a Franklin County field.

A trace of *Peronospora manshurica* was observed October 22 on 5% of the plants in a field of late soybeans in Washington County.

Pseudomonas glycinea was widespread in the State. In Franklin and Northampton Counties, infection was light on 50% and 100%, respectively, of the plants.

Rhizoctonia solani was isolated from the roots of plants taken from one Franklin County field.

Sphaceloma sp. was identified on diseased soybean plants taken from a Franklin County field. Stem and petiole lesions were presumably caused by the same fungus.

TRIFOLIUM PRATENSE, RED CLOVER. *Erysiphe polygoni* was generally distributed, with moderate infection in most fields.

Stemphylium sarcinaeforme (Macrosporium sarcinaeforme) was noted in Adams, Cumberland, and Northampton Counties, in amounts ranging from a trace on 10% of the plants to light on 90%.

Pseudopeziza trifolii was widely distributed in the State. Infection ranged from a trace of infection on a trace of the plants, to slight infection on 90% of the plants.

Uromyces trifolii was generally distributed but destructive occurrence was not observed.

ZEA MAYS, CORN. *Diplodia zeae* (ear rot) was generally distributed in southeastern and central counties. In 27 of 59 fields examined, ear rot occurred on from 0.5 to 9% of the ears.

Fusarium moniliforme was widely distributed. It occurred in 49 of the fields examined, scattered over 8 central to southeastern counties. Infection ranged from 1 to 15% of the ears.

Gibberella zeae (G. saubinetii) was observed in 15 of 59 fields, in the southeastern and central parts of the State. From 0.5 to 2% of the ears were affected.

Nigrospora sphaerica (Basisporium gallarum)(ear rot) was observed in 11 of 59 fields in the southeastern and central parts, on 0.5 to 3% of the ears.

Penicillium-Aspergillus complex was widely destributed this year owing to late maturity and to methods of harvesting. It was found in almost all lots of corn and from 0.5 to 50% of the ears were affected.

Pythium (? arrhenomanes). A trace was found in 4 of 6 Cumberland County fields examined.

Ustilago maydis (U. zeae). From 0.5 to 3% was found on ears in 29 of 59 lots examined.

FRUIT CROPS

AMYGDALUS PERSICA, PEACH. Cladosporium carpophilum was observed in Adams, Cumberland, Franklin, Lancaster, and Snyder Counties; infection varied from a trace to moderate.

Monilinia fructicola was widely distributed in central, southeastern, and eastern counties. Infection ranged from a trace to moderate in sprayed trees, and light to severe in unsprayed or poorly cared-for trees. Late varieties appeared most destructively affected.

Peach yellows (virus, Chlorogenus persicae var. vulgaris). In one Montgomery County orchard 14% of the trees were affected.

AMYGDALUS PERSICA var. NECTARINA, NECTARINE. Cladosporium carpophilum was moderately severe in one Cumberland County orchard. Monilinia fructicola was severe in one Cumberland orchard.

MALUS SYLVESTRIS, APPLE. Erwinia amylovora was generally distributed but was destructive only in abandoned or poorly managed orchards.

Gloeodes pomigena was observed in Lehigh and Snyder Counties. Infection ranged from severe in unsprayed to none in sprayed trees.

Gymnosporangium clavipes (G. germinale) was noted in Adams, Franklin, Bucks, Lehigh, and Snyder Counties, usually in not more than traces.

Gymnosporangium juniperi-virginianae was observed in Adams, Bucks, Franklin, Lebanon, Lehigh, and Snyder Counties. Infection was severe in unsprayed trees in Adams County. In other areas it usually varied from a trace to slight.

Helminthosporium papulosum was noted frequently in Adams, Lehigh, and Montgomery Counties.

Mycosphaerella pomi was observed in trace amounts in Bucks and Lehigh Counties.

Physalospora obtusa was observed in Snyder, Montgomery, Lebanon, and Lehigh Counties. Infection ranged from a trace to severe on unsprayed trees.

Venturia inaequalis was widely distributed, with much damage done to unsprayed trees.

PRUNUS spp., PLUM. *Coccomyces prunophorae* was moderately severe in a few Luzerne County orchards. Heat canker (non-parasitic) was moderately severe on the fruits on all trees in one Luzerne County orchard

PRUNUS spp., CHERRY. *Coccomyces hiemalis* was general and very destructive.

RUBUS OCCIDENTALIS, BLACK RASPBERRY, and R. IDAEUS, RED RASPBERRY. *Agrobacterium tumefaciens* was severe in one Snyder County planting. *Didymella applanata* was generally distributed in Luzerne, Snyder, Susquehanna, and Wyoming County plantings; infection was light to moderate. *Elsinoë veneta* was generally prevalent in Luzerne and Snyder County plantings. *Septoria rubi* (*Sphaerulina rubi*) occurred in light infections in a few Susquehanna and Wyoming County plantings.

Mosaic (red raspberry mosaic virus, *Marmor rubi*)was seen in almost every planting visited in Lackawanna and Luzerne Counties. Usually the percentage of diseased plants was very low.

VITIS sp., GRAPE. *Glomerella cingulata* was affecting 1% of the bunches in a Lebanon County vineyard. *Guignardia bidwellii* was observed in Adams, Lebanon, and Snyder Counties; in terms of bunches affected infection ranged from a trace to moderate. *Plasmopara viticola* was observed in Adams, Lebanon, and Lehigh Counties; infection ranged from a trace to light on as many as 90% of the plants.

SUMMARY OF OBSERVATIONS ON PLANT DISEASES IN THE NEW JERSEY-DELAWARE-MARYLAND AREA FOR THE PERIOD JULY TO DECEMBER, 1943

E. A. Walker

VEGETABLE CROPS

APIUM GRAVEOLENS, CELERY

Early blight (*Cercospora apii*) was of little economic importance. Late blight (*Septoria apii*)was observed in most plantings causing moderate to severe damage. Cracked stem (non-parasitic) occurred in only slight amounts in any field. These observations were all made in New Jersey.

ASPARAGUS OFFICINALIS, ASPARAGUS

Asparagus plantations were examined in New Jersey. In most fields visited an average of about 2 to 3% of the plants were affected by a stem rot with which *Fusarium* sp. was associated. Rust (*Puccinia asparagi*) was generally absent in midsummer, but increased during the fall. The heaviest attack observed developed in the vicinity of Woodbury in Gloucester County. In some fields about 80% of the plants were affected. In heavily infested areas parasitization of the fungus by *Darluca filum* was characteristic.

BETA VULGARIS, BEET

Leaf spot (*Cercospora beticola*) was slight to moderate in most fields in New Jersey. Stands were very poor except in irrigated sections.

BRASSICA OLERACEA var. ACEPHALA, KALE

Yellows (Fusarium oxysporum f. conglutinans) reduced the stand in a 15-acre field in Maryland about 20%.

BRASSICA OLERACEA var. CAPITATA, CABBAGE

Alternaria leaf spot generally was not destructive in NewJersey, but in a large field near Woodville A. brassicae (A. herculea) was causing severe damage to outer leaves and sucker sprout leaves.

Yellows (Fusarium oxysporum f. conglutinans) was seldom observed to be causing more than 0.5% loss in New Jersey. It was rather common in Maryland victory gardens where care was not used to select resistant varieties.

Black rot (Xanthomonas campestris) was generally unimportant in both New Jersey and Maryland. Only occasional fields were observed with severe infection.

In New Jersey, after rains in October, cracked heads (non-parasitic) damaged about 10% of the crop being harvested.

BRASSICA RAPA, TURNIP

White leaf spot (Cercosporella albo-maculans) was causing serious loss in fields near Newfield and Elmer in southwestern New Jersey, where 100% of the plants were affected. It was very common in most turnip patches in Maryland late in the season.

Mosaic (virus) affected 2% of the crop in the Newfield area of New Jersey.

CAPSICUM FRUTESCENS, PEPPER

Alternaria leaf spot (Alternaria solani) was found in one field in New Jersey in association with the Cercospora spot.

Cercospora leaf spot (Cercospora capsici) was seldom observed in New Jersey. It was noted on scattered leaves in a few fields in Maryland. In plantings near Seaford, Delaware, the disease was very severe on the leaves and some fruit pedicels.

Wilt associated with Fusarium sp. or other organisms was more destructive than other diseases in New Jersey. All fields visited showed some wilt, and in many fields from 25 to 30% was observed, while all plantings would average about 5% of the plants killed. F. annuum was isolated in some cases. Wilt associated with Fusarium sp. was noted in all fields visited in Maryland also, the average damage being about 3% of the plants killed. Some fields showed 8%, one field 20%, and the worst field observed showed 50% of the plants killed.

Anthracnose (Glomerella cingulata) was seldom observed in New Jersey. In Maryland from 6 to 8% loss of the fruit was noted in 2 fields.

Bacterial spot (Xanthomonas vesicatoria) was causing about 20% defoliation of red peppers in the Vineland section of New Jersey.

Mosaic and other virus diseases occurred in nearly all fields in New Jersey; were prominent in Delaware; in Maryland about 5% loss was noted in some fields.

An undetermined fruit rot was causing about 1% loss in one Maryland field.

Drought caused 10% loss in New Jersey, in the pepper section where rows were ridged.

Sun scald reduced the crop of salable fruits in New Jersey about 30%. Loss was slight in pepper-growing areas in Delaware. In Maryland some was observed in all fields visited and 50% loss was noted in one field in Anne Arundel County.

CITRULLUS VULGARIS, WATERMELON

Leaf blight (Alternaria cucumerina) was observed in one field of late melons near Seaford, Delaware, where nearly all the leaves were affected and many were killed, resulting in a large crop of small melons.

In Maryland, bacterial wilt (Erwinia tracheiphila) caused the death of 8 to 10% of the plants in one field, and was generally distributed in most patches visited.

CUCURBITA PEPO, PUMPKIN

Choanephora cucurbitarum was isolated along with Fusarium sp. from diseased roots of wilt-affected plants in Maryland and New Jersey, but whether it has any causal relation to the disease is not known as yet.

Wilt (Fusarium sp.) was very destructive in both States. In New Jersey losses of over 60% were estimated in some fields, and the loss in plants killed would average 15% for the State. In Maryland some fields showed from 30 to 50% of the plants killed. The State loss would average about 10%. In some cases wilt was confused with damage caused by the squash vine borer.

Downy mildew (Pseudoperonospora cubensis) was found on leaves in one New Jersey field, but the fruit was nearly mature and no damage was apparent.

Rootknot (Heterodera marioni) was severe, affecting about 10% of the plants, in a sandy field in Anne Arundel County, Maryland.

CUCURBITA PEPO var. CONDENSA, SUMMER SQUASH

Blossom blight and blossom-end rot caused by Choanephora cucurbitarum was observed in several victory gardens in Maryland. Bacterial wilt (Erwinia tracheiphila) damaged plants on low land in Maryland. Wilt (Fusarium sp.) caused serious damage to most squash plantings in New Jersey and Maryland. In some fields in Maryland 80% of the plants were killed.

IPOMOEA BATATAS, SWEETPOTATO

Pox (Actinomyces ipomoeae) was more prevalent than usual in all areas.

Black rot (Ceratostomella fimbriata)[1] was not observed in the field in Maryland at harvest but developed rapidly in storage and loss will exceed 10%. In New Jersey and Delaware it was causing about 1% and 1.5% loss, respectively, in fields observed at harvest time.

Stem rot (Fusarium spp.) was observed only to a very slight extent in Delaware, but in New Jersey and Maryland it occurred to some extent in most fields, causing losses averaging 3% in the former and about 4% in the latter. In some fields in New Jersey from 10 to 30% of the plants were wilted and killed. In Maryland up to 20% infection was noted

Scurf (Monilochaetes infuscans) occurred in most fields in New Jersey and Delaware but caused little damage. In Maryland the disease was severe in all fields and contributed greatly to root cracking.

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1 [According to Ross W. Davidson (Jour. Agr. Res. 50:800. 1935) this fungus is an Endoconidiophora, and he makes the combination E. fimbriata (Ell. & Halst.) Davidson.]

Soft rot (Rhizopus nigricans) developing on the stem end accounted for about 2% loss in one New Jersey field following a late wet harvesting season. Roots from this field would suffer considerable loss in storage. In Delaware this rot was seldom observed at harvest but since the roots were harvested while full of water, considerable loss may result in storage if they are not properly cured.

Cracking of the roots following rains after the first of October was frequently noted in New Jersey, causing a loss of about 2%. It was severe in most Delaware fields where fully 10% or more of the crop was damaged in this manner. In Maryland it was very severe in low land. The average loss in this State amounted to 8 to 10%, and some fields were not dug because of this condition.

Drought reduced the New Jersey crop about 30%, and resulted in the marketing of a larger number of small size sweetpotatoes than usual. In Maryland also the crop as a whole was reduced about 30% by drought, and the yield of roots grading U. S. No. 1 to about 25% of normal.

LYCOPERSICON ESCULENTUM, TOMATO

Early blight (Alternaria solani) was present to a damaging extent on the foliage in all fields visited in New Jersey. In Delaware and Maryland it caused defoliation of the lower leaves of the late crop; stem infection was observed to some extent in Delaware and was abundant in Maryland. A reduction in yield of about 4% occurred in Delaware.

Leaf mold (Cladosporium fulvum) was observed generally distributed in one field near Cordova, Maryland. Outdoors infection by this fungus is not common in the State.

Bacterial canker (Corynebacterium michiganense) was observed in one Maryland field. The loss in the field averaged 3%, but in some parts of it 50% of the plants were killed.

Fusarium wilt (Fusarium oxysporum f. lycopersici) caused a loss in Maryland averaging approximately 5%. It was very severe near Cambridge, where the average loss was 8% and 35 to 50% of the plants were missing in parts of some fields. Fusarium wilt and verticillium wilt (Verticillium albo-atrum) together caused death of about 5% on the average of plants in Delaware and New Jersey commercial tomato sections. In New Jersey from 16 to 33% of the plants in some fields were killed by one or the other.

Late blight (Phytophthora infestans) was noted only in Maryland, where a slight amount was observed on the foliage in 2 fields late in the season, causing no damage.

Bacterial wilt (Pseudomonas solanacearum) was severe in one Maryland field.

Leaf spot (Septoria lycopersici) caused serious defoliation in some fields in northwestern New Jersey. Some defoliation was observed in the Cheswold area of Delaware, with reduction in yield of about 1%. The disease caused slight damage on the Eastern Shore and moderate damage in northern and western Maryland. Some defoliation was noted.

Gray leaf spot (Stemphylium solani) may have caused some of the damage attributed to early blight in New Jersey.

Mosaic (virus) occurred in most fields in Delaware but was causing only slight damage. It was observed in most plantings in New Jersey also.

Blossom-end rot (physiogenic) was more prevalent than usual in New Jersey and caused a loss of more than 15%. Late tomatoes in Delaware and Maryland were badly affected but the disease decreased in severity after the middle of September. Loss in Delaware was fully 5%, in Maryland about 8%. From 30 to 50% of the fruits were affected in some Maryland fields.

Stem-end cracking of the fruit was observed in the late crop in Maryland following the rains after the middle of September.

Drought reduced the late-season crop in New Jersey and Maryland by 30%, and was responsible for the large number of small fruits. The early crop in New Jersey was slightly affected.

PETROSELINUM CRISPUM, PARSLEY

Stunt (virus) was found in one New Jersey planting near Elmer.

RADICULA ARMORACIA, HORSERADISH

White rust (Albugo candida), leaf spots caused by Alternaria brassicae (A. herculea) and Colletotrichum sp., and downy mildew (Peronospora parasitica) were observed in all of the mostly small plantings examined in New Jersey.

SOLANUM MELONGENA, EGGPLANT

Anthracnose (Colletotrichum atramentarium) was seldom observed in New Jersey plantings. About 8% of the fruits in one field in Anne Arundel County, Maryland, were affected.

Wilt (Fusarium sp) caused an average of about 6% loss to truck growers in Maryland. Wilt due to Fusarium and to Verticillium albo-atrum was the most destructive disease of eggplants in New Jersey. Most fields contained 1% or more, with an average of about 5%, while in some fields from 30 to 40% of the plants were wilted. Verticillium was possibly the more important in this State.

Stem canker and fruit rot (Phomopsis vexans) caused no damage to the early crop in New Jersey, but loss in the late crop amounted to 30 to 50%. Stem cankers caused the death of some plants before frost. In one field observed in Maryland about September 15, about 26% of the plants were killed and 35% of the fruit was affected.

Cracked fruit following fall rains developed to a severe extent in New Jersey.

SOLANUM TUBEROSUM, POTATO

Scab (Actinomyces scabies) was observed occasionally in New Jersey but was not severe. In Maryland it was practically absent on the late crop in the lower elevations of the eastern part of the State, but was very severe in western Maryland where some varieties averaged from 10 to 15% deep scab and 15 to 20% surface scab.

Early blight (Alternaria solani) was generally slight to moderate on the late crop throughout the area.

Bacterial ring rot (Corynebacterium sepedonicum) was observed on Katahdin potatoes in Garrett County in western Maryland at harvest, the first record for this part of the State. The disease was introduced with a carlot of "Select" northern seed that was distributed to over 400

victory gardeners. Tubers infected in the crop from this seed amounted to about 6%.

Rhizoctonia (Pellicularia filamentosa)(Corticium solani) caused severe black scurf on tubers in western Maryland. No aerial tubers were observed.

Late blight (Phytophthora infestans) was practically absent in most sections. In New Jersey tuber rot was observed in only one field, of the Chippewa variety. In western Maryland where rain was plentiful late blight reduced the crop in unsprayed fields about 25%.

Brown rot (Pseudomonas solanacearum) was observed to cause slight damage in a field of late potatoes in Caroline County, Maryland.

Leaf roll (virus) was serious in the late crop on the Eastern Shore of Maryland, with over 3% of the plants affected.

Drought affected the late crop in Delaware and Maryland, reducing stands about 30%.

CEREALS, GRASSES, AND FORAGE CROPS

FAGOPYRUM ESCULENTUM, BUCKWHEAT. A stem rot of undetermined origin was killing about 1% of the plants in a field near Seaford, Delaware.

MEDICAGO SATIVA, ALFALFA. Leaf spots (Pseudopeziza medicaginis and Pyrenopeziza medicaginis) caused severe defoliation of the uncut or seed crop in New Jersey late in the season. New growth showed only slight leaf spotting with no apparent loss. In Delaware leaf spots caused considerable defoliation of the lower leaves after the second cutting.

SOJA MAX, SOYBEAN. Frog-eye (Cercospora sojina) (C. daizu) was observed to a limited extent in Delaware. In Maryland slight infection was noted in 2 fields visited. Bacterial spot (Pseudomonas glycinea) and bacterial pustule (Xanthomonas phaseoli var. sojense) caused about 2% loss in Delaware and were observed frequently in Maryland.

Drought was severe in both Delaware and Maryland, reducing the crop 30 to 35%.

SORGHUM VULGARE var. SUDANENSE, SUDAN GRASS. Leaf blight (Helminthosporium turcicum) was very severe in all fields examined throughout the area, drying up the leaves and rendering the crop useless for silage or hay.

TRIFOLIUM spp., CLOVER. Powdery mildew (Erysiphe polygoni) was very pronounced by late summer.

ZEA MAYS, CORN. Ear rots caused by Diplodia zeae and Fusarium moniliforme were less common than usual. Loss from Diplodia was about 1.2% in Delaware and Maryland and did not exceed 2% in New Jersey; loss due to Fusarium was about 1%.

Stalk and root rot caused by Diplodia zeae was severe in St. Mary's County, Maryland, where losses averaged about 5%.

Leaf blight (Helminthosporium turcicum) was of minor importance. It was observed only in northwestern New Jersey, very late in the season, and in northeastern Maryland.

Smut (Ustilago maydis) (U. zeae) infection amounted to less than 1% throughout the area. Ear infection was practically absent in Delaware and New Jersey.

Drought, in Maryland, reduced the yield about 30%.

ZEA MAYS, SWEET CORN. Ear infection by smut (Ustilago maydis) in Delaware appears to be increasing. The crop from some fields showed 20% or more affected ears when received at the canning factories.

FRUIT CROPS

AMYGDALUS PERSICA, PEACH

Scab (Cladosporium carpophilum) was seldom observed in well-sprayed orchards, but was severe in some poorly managed plantings. Over 50% infection of the fruit, severe shot-hole with defoliation, and some twig infection were noted in some Maryland orchards. The variety Lizzie was severely affected in one New Jersey orchard, evidently not well-sprayed.

Brown rot (Monilinia fructicola) caused but slight loss in Maryland and was practically absent in Delaware and New Jersey. The variety J. H. Hale showed most infection in Maryland, and orchards with heavy infestations of the oriental peach moth were also most heavily attacked by brown rot. One block of J. H. Hale near Dover, Delaware showed a loss of 2 to 4%.

Constriction disease (Phoma persicae) was observed in several young and old orchards in Maryland, manifested by a yellowing of leaves on the affected branches. The results from severe stem infection occurring during the 1941 season are becoming pronounced.

Bacterial spot (Xanthomonas pruni) was the most destructive disease of peach observed in New Jersey. The varieties Elberta, Goldeneast, Halehaven, J. H. Hale, and Summercrest showed most severely affected fruits, while none or only slight infection occurred on Golden Jubilee and Belle. The disease was severe in 3 far-separated orchards in Maryland. Varieties showing the greatest fruit injury were Brackett, Champion, Early Elberta, Elberta, Goldeneast, Goldenglobe, Halehaven, J. H. Hale, Late Elberta, Redskin, Rio Oso Gem, Summercrest, Roberta, Sunhigh, and White Hale. Near Dover, Delaware, bacterial spot was severe on fruits of J. H. Hale, Elberta, and Shippers Late.

Little peach (virus) was observed in scattered orchards in New Jersey, to the extent of about 1%.

Spray injury in the form of marginal leaf burning was very pronounced in most orchards in Delaware; this type of injury may also have been associated with drought injury. Severe spray burn was noted in one Maryland orchard where summer oil used on apples drifted across the peach block. In this State also, especially severe arsenical injury was noted on Salwey and Krummell in one instance, where 5% of the fruit was damaged and 60% of the leaves were lost.

Freezing of the fruit buds by spring frosts was responsible for about 85% reduction in the crop in Delware, and 75% reduction in Maryland. On the Eastern Shore and in southern Maryland frost caused 90% reduction in the crop; in the mountain areas of western Maryland, on the other hand, the crop was about 80% of normal.

Crotch splitting due to winter injury was observed on 50% of the trees of the Raritan Rose variety in one New Jersey orchard.

JUGLANS REGIA, PERSIAN WALNUT

Leaf spot (Marssonia juglandis) was causing premature leaf drop on one tree in the Barnsboro section of New Jersey.

MALUS SYLVESTRIS, APPLE

Fire blight (*Erwinia amylovora*) was not active during the summer or fall. Jonathan and Wealthy showed some injury in Maryland.

Bitter rot (*Glomerella cingulata*) was of very slight importance throughout the area. In New Jersey it was observed mostly on Grimes Golden and Golden Delicious fruits. In Delaware it was practically absent in orchards visited except in one block of the Stark variety near Cheswold in which about 10% of the fruit was affected. In scattered orchards in Maryland, Grimes Golden showed 10% fruit infection, Maiden Blush 2%, Winter Banana a trace, Nero 2%, and Black Twig a trace.

Cedar rust (*Gymnosporangium juniperi-virginianae*) was severe on leaves of Rome Beauty in New Jersey. In Maryland it was more prevalent on the leaves than usual, but the fruit remained comparatively clean; on York Imperial 50% infection of the leaves was often observed whereas Jonathan showed only 1% infection. Mostly slight leaf infection was noted on Rome Beauty although in one orchard 30% was observed.

Black pox (*Helminthosporium papulosum*) was severe on Rome Beauty fruit from trees showing twig symptoms of measles in Maryland, while *Coniothyrium fuckelii* was isolated from such affected twigs.

Fruit spot (*Mycosphaerella pomi*) was observed in one orchard in northeastern Maryland.

Black rot (*Physalospora obtusa*) leaf infection (frog-eye) was more common than usual in Maryland. It appeared most frequently on York Imperial; 40% of the leaves of this variety were affected in one orchard. Yellow Transparent, Northwestern Greening, and Winter Banana were lightly affected. One block of Nero showed 2% loss from fruit rot.

Scab (*Venturia inaequalis*) was practically absent or very light on the fruit in most of the area. Early season leaf infection was also light, but a considerable amount developed on leaves late in the season, particularly on Delicious, Grimes Golden, Rome Beauty, Stayman Winesap, and York Imperial. In eastern New Jersey moderately severe infection was observed on McIntosh and Stayman Winesap, and to some extent on Delicious, fruit.

Drought injury was severe and resulted in small fruit that dropped off early.

Late blossoming was observed August 25 in a neglected orchard near Cheswold, Delaware. Leaves were few and there was no fruit on the trees.

Spray injury resulted in considerable leaf marginal burning in several orchards in Maryland. Some fruit injury was observed on Gano and York Imperial in two orchards.

RUBUS SP., RASPBERRY

In raspberry plantings observed in Maryland, spur blight (*Didymella applanata*) was generally distributed; about 10% of the canes were affected by anthracnose (*Elsinoë veneta*); a slight amount of cane blight (*Leptosphaeria coniothyrium*) occurred in commercial plantings; verticillium wilt (*Verticillium albo-atrum*) was responsible for most of the dead canes.

SPECIAL CROPS

NICOTIANA TABACUM, TOBACCO

In Maryland granville wilt (Pseudomonas solanacearum) was observed in 2 fields, one of Maryland Medium Broadleaf, and the other of Burley type. Losses amounted to 25-30% of plants killed. Mosaic (virus) was more severe than usual; average number of plants affected was about 20%. Ringspot (virus) was light, resulting in about 1.5% plants affected. Drought injury (weather) reduced the total crop 40%.

PLANT DISEASES IN OHIO DURING 1943

M. R. Harris

During the 1943 growing season, Ohio weather was somewhat abnormal. The spring was late. Precipitation was higher than normal which resulted in soil too wet to cultivate until as much as several weeks after the usual planting dates. In the middle and latter part of the growing season there was a scarcity of rainfall in the central and southern portions of the State resulting in some crops, such as corn and soybeans, ripening somewhat prematurely. However, the lack of rainfall late in the season made possible the harvesting of relatively disease-free corn and soybean crops.

VEGETABLE DISEASES

ALLIUM CEPA, ONION

Onions were damaged by hot wet weather which resulted in a scald of the bulb tops. Later, soft rot bacteria completed the breakdown. Pink root caused some loss where the fungus (Phoma terrestris) was present in the soil. Smut (Urocystis cepulae) was largely controlled by proper treatments at planting time.

APIUM GRAVEOLENS, CELERY. Early blight (Cercospora apii) of celery was not serious but late blight (Septoria apii) caused some injury where fields were not properly sprayed. Yellows (Fusarium oxysporum f. apii) was not an economic factor in celery production this year due largely to the planting of resistant varieties.

ASPARAGUS OFFICINALIS, ASPARAGUS. In some plantings, rust (Puccinia asparagi) is becoming a serious problem. Among growers, the opinion seems to be that resistant plants are gradually becoming susceptible.

BRASSICA OLERACEA var. CAPITATA, CABBAGE. The yellows disease (Fusarium oxysporum f. conglutinans) of cabbage was not damaging, owing largely to the planting of resistant varieties. Blackrot (Xanthomonas campestris) was quite a factor in some fields and caused a 4% loss over the entire State. Club root (Plasmodiophora brassicae) persists in a few places and caused a 0.5% loss in cabbage growing areas.

CUCUMIS MELO, CANTALOUP. Cantaloups were attacked by the anthracnose organism (Colletotrichum lagenarium) much less than last year. Bacterial wilt (Erwinia tracheiphila) was much more prevalent than last year and caused a 5% loss. Fusarium wilt (Fusarium sp.) was no more severe than

in an average year, causing a trace of damage. Leaf spot (Alternaria cucumerina) and mosaic caused only a trace of loss.

CUCUMIS SATIVUS, CUCUMBER. Anthracnose (Colletotrichum lagenarium) caused a 1% loss on cucumbers. Bacterial wilt (Erwinia tracheiphila) was more severe, causing a 3% loss. There was a trace of angular leaf spot (Pseudomonas lachrymans) in a few fields. Mosaic is becoming quite severe on some varieties of cucumbers, reducing the pick by more than half. Over the State this disease caused a 4% loss.

DAUCUS CAROTA, CARROT. Leaf blight (Cercospora carotae and Alternaria carotae) of carrots was no more severe than usual and caused a 6% reduction of the crop.

LYCOPERSICON ESCULENTUM, TOMATO. Tomatoes were attacked by early blight (Alternaria solani) early in the season during weather favorable to the disease. Losses up to 90% were seen in some fields, but over the entire season only 1% loss was sustained. Leaf mold (Cladosporium fulvum) while quite general in its distribution caused only 0.5% damage to the crop. Anthracnose fruit spot (Colletotrichum phomoides) was severe in spots and destroyed 7% of the State crop. A trace of wilt (Fusarium oxysporum f. lycopersici) was noted. Blossom-end rot was not very prevalent this past season. In some greenhouses it is a serious problem. Bacterial canker (Corynebacterium michiganense) was most often found on plants brought in from southern states which were delayed in being planted. There was a 1% loss from this disease. Leaf spot (Septroia lycopersici) was a factor in tomato production only locally where it caused a reduction in yield up to 75% in a few fields. The lateness of the season was not favorable to the development of leaf blight. There was a trace of wilt (Verticillium sp.) but the cool summer reduced the amount of this trouble. There was a 1% loss from virus diseases over the State but individual fields ran as high as 100%.

PHASEOLUS VULGARIS, BEAN. The bean crop was reduced 2% by anthracnose (Colletotrichum lindemuthianum). Powdery mildew (Erysiphe polygoni) did little damage generally but isolated fields in the northern part of the State were severely damaged late in the season. Bacterial blight (Xanthomonas phaseoli and/or Corynebacterium flaccumfaciens) caused a 0.5% reduction in the crop and was favored by wet weather early in the season.

PISUM SATIVUM, PEA. The pea crop was reduced 5% by seed decay and root rot caused by Fusarium sp. and favored by wet soil early in the season.

SOLANUM MELONGENA, EGGPLANT. Eggplant fields were severely damaged by wilt (Verticillium sp.) and over the State generally there was a 10% loss.

SOLANUM TUBEROSUM, POTATO. Potatoes were damaged to a moderate degree by scab (Actinomyces scabies) and there was a 1% loss. Early blight (Alternaria solani) was more prevalent than usual this past year and reduced the crop by 2.5%. In three fields of the State bacterial ring rot (Corynebacterium sepedonicum) was known to occur. The source of the disease was infected seed. On muck areas scurf and stem rot (Pellicularia filamentosa) (Corticium solani) did a slight amount of damage. Here and there a trace of blackleg (Erwinia phytophthora) was found. Wilt (Fusarium spp.) was about as prevalent as usual and the loss was 0.5%. Late blight early in the season promised to be serious but weather unfavorable to its development later in the season reduced the loss to a trace. The

fungus (Phytophthora infestans) was found near Columbus late in July. The virus diseases exclusive of leaf roll reduced the crop by 1%. Leaf roll was more severe and caused a 4% loss. Insect injury due to leaf hoppers was more severe than usual and was estimated at 8%.

CEREAL DISEASES

AVENA SATIVA, OATS. On oats there was a trace of leaf blotch (Helminthosporium avanae) this past season. A trace of halo blight (Pseudomonas coronafaciens) was found in the northwestern part of the State. Leaf rust (Puccinia coronata) was general and reduced the crop by 1%. Traces of stem rust (Puccinia graminis var. avenae) were found in widely scattered localities. Loose smut (Ustilago avenae) was general and caused a 0.5% loss while covered smut (Ustilago kolleri) was more severe and reduced the yield by 1.0%.

HORDEUM VULGARE, BARLEY. On barley a trace of ergot (Claviceps purpurea) was found. In four fields a trace of mildew (Erysiphe graminis) occurred. In the southern part of the State scab (Gibberella zeae) was observed in 4 fields and in one it had damaged the heads severely. A few traces of blotch (Helminthosporium spp.) were seen. Leaf rust (Puccinia anomala) was fairly prevalent but caused no loss. Stem rust (Puccinia graminis) likewise was scattered but not severe. Loose smut (Ustilago nuda) reduced the crop by 1.0% and covered smut (Ustilago jensenii) by 2%.

SECALE CEREALE, RYE. Ergot (Claviceps purpurea) on rye was severe in spots causing as high as 25% loss in isolated fields but over the State generally reduced the crop by 1%. Scab (Gibberella zeae) in one field infected 30% of the heads but averaged only a trace for the State. Traces of leaf rust (Puccinia rubigo-vera var. secalis) and stem rust (Puccinia graminis) were seen. In one field a trace of stem smut (Urocystis occulta) was present.

TRITICUM AESTIVUM, WHEAT. A trace of anthracnose (Colletotrichum graminicolum) was seen in Ashland County. One field showed traces of powdery mildew (Erysiphe graminis tritici). Scab infection was general and frequently severe. Percentage of heads infected with the fungus (Gibberella zeae) ran as high as 85 in some fields and for the State generally the loss was 12%. Stem rust (Puccinia graminis) was of general distribution and caused a 2% loss while leaf rust (Puccinia rubigo-vera var. tritici) was less severe and reduced the crop by 1%. A trace of glume blotch (Septoria nodorum) was found in four fields. There were traces of bunt (Tilletia levis) fairly common over the State but loose smut (Ustilago tritici) was much more general but not an economic factor.

ZEA MAYS, CORN. The corn crop was generally fairly free of disease. Ear rot (Diplodia, Gibberella and other fungi) was most common in the northern part of the State and reduced the crop by 0.8%. There was a trace of stalk rot caused by these same organisms. In the south half of the State, leaf blight (Helminthosporium turcicum) was quite prevalent but developed late in the season and caused only 1% loss. There was a trace of Stewart's wilt disease (Bacterium stewartii) in field corn but sweet corn showed an average loss of 3%. Smut (Ustilago maydis) reduced

the field corn crop by 0.6% and sweet corn by 2%.

FIELD CROP DISEASES

BETA VULGARIS, SUGAR BEET. On sugar beets, leaf spot (Cercospora beticola) caused a 2% loss which would have been much heavier if resistant varieties had not been planted. Many fields were lost in the seedling stage because of various fungi causing a black root condition aided by wet weather.

MEDICAGO SATIVA, ALFALFA. Alfalfa is grown in the western and northern parts of the State. The wilt and root rot disease (Corynebacterium insidiosum) is severe in many fields and reduces the crop annually by 5%. Leaf spot (Pseudopeziza medicaginis) is present in every field but does very little damage.

NICOTIANA TABACUM, TOBACCO. Tobacco is a minor crop in Ohio. In one field a trace of angular leaf spot (Pseudomonas angulata) was seen. Black root rot (Thielaviopsis basicola) reduced the crop by 4%. Traces of downy mildew (Peronospora tabacina) and wildfire (Pseudomonas tabaci) were present in a very few fields.

SOJA MAX, SOYBEAN. Soybeans were planted late over much of the State but due to very favorable weather late in the season matured a normal crop. Frog-eye spot was common over the State but severe in only a few fields. It reduced the crop by 0.5%. There was a trace of pod and stem blight (Diaporthe sojae). Anthracnose (Glomerella glycines) cut the yield by 0.1%. Mildew (Peronospora manshurica) at one time in the season appeared to be on the verge of a severe outbreak but finally damaged the crop by only 1%. Various virus and mosaic diseases were widely scattered. "Bud blight" was the most severe. The loss from all viruses is estimated at 1%. Bacterial pustule (Xanthomonas phaseoli var. sojense) was present in every field examined but seldom was serious and caused a loss for the State estimated at 2 %.

FRUIT DISEASES

AMYGALUS PERSICA, PEACH. On peaches, there was a trace of scab (Cladosporium carpophilum) which is less than in an average year. There was at least a 2% loss from brown rot (Monilinia fructicola) in the orchard and probably much more by the time the fruit was used. Bacterial blight (Xanthomonas pruni), leaf curl (Taphrina deformans), canker (Valsa leucostoma), and virus diseases (little peach and yellows) were all present as traces but did no appreciable damage,

FRAGARIA SPP., STRAWBERRY. Strawberries were infected with leaf spot (Mycosphaerella fragariae) but no appreciable damage was done. In some plantings traces of red stele (Phytophthora fragariae) were observed. Root rots caused by various fungi favored by poor growing conditions killed 5% of the State's plants.

MALUS SYLVESTRIS, APPLE. On apples, there was very much less fire blight (Erwinia amylovora) than in an average year and no damage was done. Bitter rot (Glomerella cingulata) was much more prevalent in southern Ohio than in an average year. Damage was 0.5%. The usual trace of cedar rust (Gymnosporangium juniperi-virginianae) was present in a number of

commercial orchards. In southern Ohio, pox disease (*Helminthosporium papulosum*) was more prevalent than in an average year but no appreciable damage over the State generally was recorded. Here and there a trace of Brook's spot (*Mycosphaerella pomi*) could be found. Blotch (*Phyllosticta solitaria*) could be found where spraying was not done properly. There was an early severe leaf infection of black rot (*Physalospora obtusa*) in southern Ohio which resulted in statewide damage of 0.3%. Scab (*Venturia inaequalis*) was severe and favored by weather conditions early in the season. The total loss for the State was 10%.

PRUNUS SPP., CHERRY. Cherry leaf spot (*Coccomyces hiemalis*) was more severe than usual during the past season and defoliated trees which were not sprayed. In some commercial orchards weather conditions prevented spraying at the proper time and in such orchards some defoliation resulted. The loss over the State was estimated at 1%. There was a trace of brown rot (*Monilinia fructicola*) when the fruit was ripening.

PRUNUS SPP., PLUM. On plums there was a trace of bacterial spot (*Xanthomonas pruni*). Brown rot, with the aid of insect damage, was severe and destroyed 12% of the crop.

PYRUS COMMUNIS, PEAR. On pears, traces of black spot (*Fabraea maculata*), fire blight (*Erwinia amylovora*), and scab (*Venturia pyrina*) were observed. Fire blight was less common than other years while black spot was seen more often.

RUBUS SPP., RASPBERRY. Raspberry cane blight (*Leptosphaeria coniothyrium*) was more prevalent than in an average year but did no appreciable damage. About 2% of nursery plants were found infected with crown gall (*Agrobacterium tumefaciens*). Anthracnose (*Elsinoë veneta*) took a heavy toll in some plantings and damaged the whole State to the amount of 8%. Virus diseases were found on 0.5% of the plants observed.

VITIS SPP., GRAPE. On grapes, the black rot fungus (*Guignardia bidwellii*) was very destructive and in many home vineyards which were not sprayed the crop was a total loss. Commercial vineyards that received 2 or more regular sprays were fairly free from the trouble. The State loss was 10%. A trace of both downy mildew (*Plasmopara viticola*) and powdery mildew (*Uncinula necator*) were seen but did no appreciable damage.

PLANT DISEASES AND RESULTING CROP LOSSES IN INDIANA, 1943

R. C. Baines

This report was prepared in collaboration with R. M. Caldwell, C. T. Gregory, and R. W. Samson of the Purdue University Agricultural Experiment Station and Arnold J. Ullstrup, of the Division of Cereal Crops and Diseases, U. S. Bureau of Plant Industry, Soils, and Agricultural Engineering. Specific recognition for the information presented is made by name under each disease.

PROBABLE INFLUENCE OF RAIN ON THE DEVELOPMENT OF DISEASES ON CROPS IN INDIANA DURING 1943

The rainfall during May in central and northern Indiana was approximate-

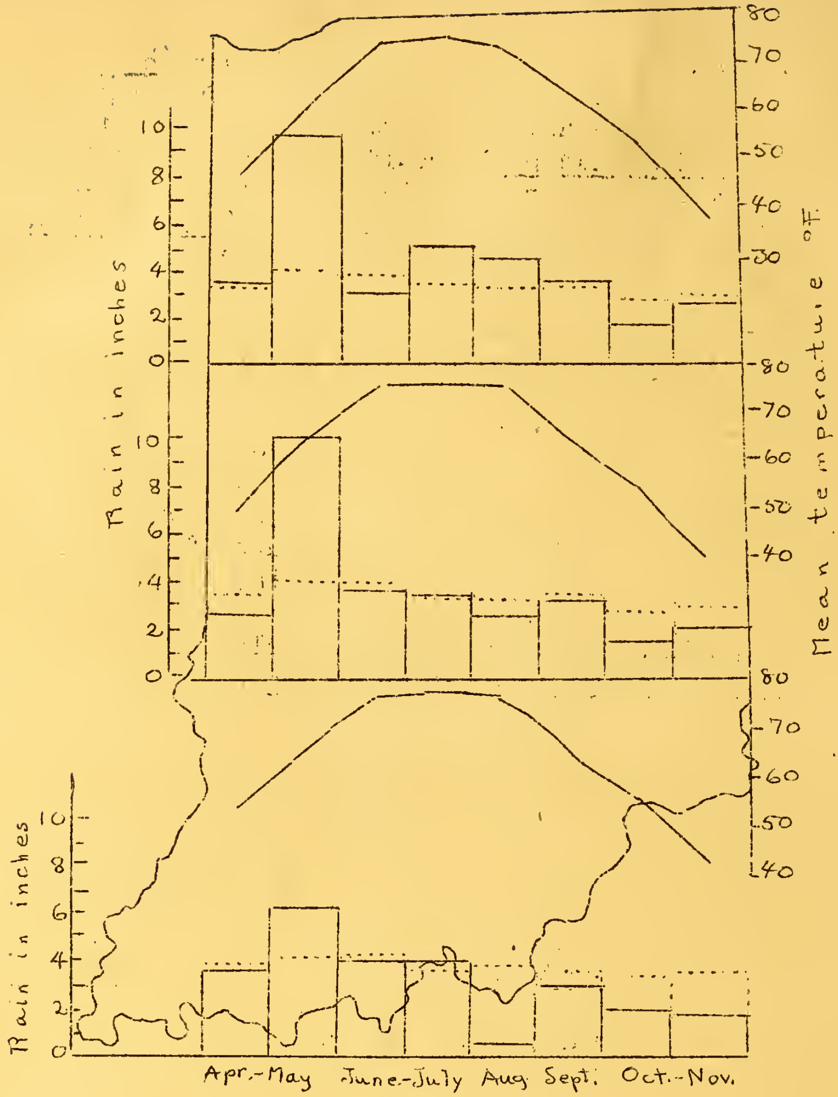

Figure 1.

Inches of rain and mean temperature in northern, central, and southern Indiana during the months of April to November, 1943.

Legend:

 = actual rainfall

 = average (56 years) rainfall

ly 2-1/2 times the average amount (see Figure 1). From June to September, inclusive, the rainfall in central Indiana departed only slightly from the average, while in northern Indiana it was slightly more than the average amount. The rainfall was considerably below the average during October in northern Indiana and during October and November in central Indiana.

In southern Indiana the rainfall during May was 1-1/2 times the average amount and in June and July approximately the average precipitation occurred. However, during the remainder of the summer and in the fall the rainfall in this area was much below normal.

With the abundant rainfall during May conditions apparently were exceptionally favorable for the development of wheat scab (Gibberella zeae) and apple scab (Venturia inaequalis).

The normal and above-normal rainfall from June through September in central and northern Indiana was favorable for the development of pustule spot (Xanthomonas phaseoli var. sojense) and downy mildew (Peronospora manshurica) of soybeans, late blight (Phytophthora infestans) of potatoes, leaf-spot (Septoria lycopersici) of tomato, leaf-spot (Cercospora zebrina) of red clover, cherry leaf-spot (Coccomyces hiemalis), leaf-blight (Helminthosporium turcicum) of corn, apple scab, etc.

In southern Indiana the rains were somewhat spotted during the summer and certain areas, especially the southwest corner, were very dry. The leaf-spot diseases and some fruit-rots, such as bitter-rot of apple, were not very prevalent nor severe in southern Indiana.

The below-average rainfall during October and November in Indiana appeared to check the spread of most diseases. Thus, very few potato tubers were infected with late blight, even in fields in which the foliage was blighted severely, and the percentage of corn ears that were infected with Diplodia zeae was below normal.

DISEASES OF VEGETABLES

ALLIUM CEPA, ONION

Erwinia carotovora (soft rot) was common on dried onions. In home gardens considerable rot was evident at harvest, especially on white Bermuda onions, and losses ranged from 10 to 60%. A trace of soft rot was found in commercial fields of yellow onions on muck soils in northern Indiana. Losses ranged from 2 to 4% in topped and cured onions according to R. C. Baines.

Phoma terrestris (pink root rot). Onions on soil on which a number of crops of onions had been grown in the past usually were affected slightly to severely with pink root rot. No attempt was made to interpret the degree of infection as reduction in yield, although it is assumed that severe infection and killing of the roots must affect detrimentally the size of the bulbs. -- R. C. Baines

Urocystis cepulae (smut). A trace occurred on young onions. This disease apparently is controlled satisfactorily by seed treatments according to C. T. Gregory.

APIUM GRAVEOLENS, CELERY

Cercospora apii (early blight) occurred generally on celery and caused severe injury in northern Indiana. The estimated loss was 20%. A trace of celery affected with Fusarium oxysporum f. apii (Fusarium yellows) was observed. Varieties resistant to the disease are usually grown. Septoria sp. (late blight) caused a trace of infection and loss. -- C. T. Gregory.

BETA VULGARIS, BEET

Actinomyces scabies (scab) caused 5% loss in marketable beets in one field in northern Indiana according to R. W. Samson. The loss for the State is placed at a trace.

Cercospora beticola (leaf spot) occurred on practically all beets and very likely caused 2 to 5% loss in yield. -- R. C. Baines and C. T. Gregory.

BRASSICA OLERACEA var. ACEPHALA, KALE

Fusarium oxysporum f. conglutinans (yellows). Between 5 and 20% of the plants in market garden plantings were affected with yellows, which resulted in approximately 10% loss for the State. -- C. T. Gregory

BRASSICA OLERACEA var. CAPITATA, CABBAGE

Erwinia carotovora (bacterial soft rot) caused a head rot in the field in early summer in northern Indiana. The prevalence and severity of this disease appeared to be due to the frequent heavy rain (see rainfall map, figure 1). The loss is estimated at 5% by C. T. Gregory and R. C. Baines.

Fusarium oxysporum f. conglutinans (yellows). Between a trace and 5% of yellows-affected plants occur in most fields. Resistant varieties are usually grown. The average loss is estimated to be 2% by C. T. Gregory and R. C. Baines.

Plasmodiophora brassicae (clubroot). In 2 fields in northern Indiana approximately 75% of the plants were infected, resulting in 50% loss. The estimated loss for the State was a trace. -- C. T. Gregory and R. C. Baines.

Xanthomonas campestris (black rot). A trace occurred in a few of the fields observed by R. C. Baines and C. T. Gregory.

BRASSICA PEKINENSIS, CHINESE CABBAGE

Xanthomonas campestris (black rot). In a half-acre planting near Indianapolis 15% of the plants were infected severely. The average loss from this disease for the State is about 1%. -- C. T. Gregory.

CAPSICUM FRUTESCENS, PEPPER

Xanthomonas vesicatoria (bacterial spot). In a few fields this disease reduced the foliage by 5%. The average loss in yield (including fruit infection) was about 0.5%.

Mosaic (virus). In a few plantings 50% of the plants were infected, and the average loss in yield in the State is estimated at 5%.

Sun scald (non-parasitic). The loss of fruit from sun scald is estimated at 10%. -- C. T. Gregory and R. C. Baines.

CICHORIUM ENDIVIA, ENDIVE

Aster yellows (virus) occurs in nearly all plantings and the loss is estimated at 5%. -- C. T. Gregory.

CITRULLUS VULGARIS, WATERMELON

Alternaria cucumerina (leaf blight) occurred in most plantings and caused slight defoliation and 0.2% (estimated) reduction in yield. -- R. C. Baines and C. T. Gregory.

Colletotrichum lagenarium (anthracnose). Slight to moderate infection of the leaves occurred in most plantings. Severe infection of the fruit occurred late in the fall in northern Indiana. The average estimated loss from anthracnose was 0.5%. -- R. C. Baines.

Fusarium oxysporum f. melonis (wilt). A trace occurred in occasional plantings of susceptible varieties. -- R. C. Baines and C. T. Gregory.

Pythium spp. (blossom-end rot) occurred in all of the fields examined and the estimated average loss was 5%.

CUCUMIS MELO, CANTALOUP

Alternaria cucumerina (leaf blight) occurred rather generally over the State and caused about 1% loss.

Colletotrichum lagenarium (anthracnose). Slight to moderate infection occurred on the leaves in central and northern Indiana. In southern Indiana the rainfall was deficient during the summer and practically no anthracnose was found in that area. It is estimated that anthracnose caused 0.2% loss for the State.

Erwinia tracheiphila (bacterial wilt) was of general occurrence in the State and caused an estimated 5% loss.

Fusarium oxysporum f. melonis (Fusarium wilt). In a few fields in southwestern Indiana between 10 and 15% of the plants were infected severely. The average loss for the State was estimated to be 0.1%. -- R. C. Baines and C. T. Gregory.

CUCUMIS SATIVUS, CUCUMBER

Erwinia tracheiphila (bacterial wilt) was of general occurrence in the State. The percentage of plants infected in the different fields ranged from 5 to 50, and the average estimated loss was 10%. -- R. C. Baines and C. T. Gregory.

Heterodera marioni (rootknot). In occasional greenhouses nematodes caused approximately 20% loss. The estimated loss in yield for the State was 0.1%. -- C. T. Gregory.

DAUCUS CAROTA, CARROT

Alternaria carotae (leaf blight) was of general prevalence and caused an estimated reduction in yield of 5%. -- R. C. Baines and C. T. Gregory.

IPOMOEA BATATAS, SWEETPOTATO

Actinomyces sp. (soil rot) occurred in 20% of the sweetpotato fields in Indiana. In 15% of the fields only a trace was noted; however, in 5% of the fields approximately 21% of the fleshy roots were infected slightly to moderately. Soil rot caused approximately 0.2% loss in yield and quality in Indiana.

Ceratostomella. See Endoconidiophora.

Diaporthe batatatis (dry rot) was found in storage houses on an occasional root. This disease caused no appreciable loss in Indiana.

Endoconidiophora fimbriata (Ceratostomella fimbriata) (black rot). A trace of black rot was found in 10% of the fields at harvest, but none was seen on roots examined in storage during the winter. The loss in yield in Indiana from black rot was a trace.

Fusarium oxysporum f. batatas. Stem rot or wilt was the most serious and widespread disease of sweetpotatoes in southern Indiana in 1943. It occurred in 90% of the fields examined, and from a trace to 33% of the plants were infected severely and killed or badly stunted, while the yield from moderately infected plants was reduced about 25%. The average reduction in yield due to wilt in the State was about 10%.

Some sweetpotatoes affected with fusarium surface rot were found in all lots examined in storage houses during December, totaling about 0.5% of the roots in storage. In occasional lots about 3% of the sweetpotatoes were discarded because of surface rot.

Pythium ultimum (mottle-necrosis and ring rot). A trace of mottle necrosis occurred on Yellow Jersey sweetpotatoes in 10% of the fields. In storage only a trace of ring rot was observed.

Rhizopus nigricans (soft rot). In one lot of sweetpotatoes stored in tight, poorly ventilated baskets approximately 3% of the roots were infected. The average was about 0.5% of the sweetpotatoes in storage infected.

Sclerotium bataticola (charcoal rot). Occasional roots infected with this fungus were found in storage. -- R. C. Baines

LACTUCA SATIVA, LETTUCE

Botrytis cinerea (gray mold). A trace was found on the first planting in a few greenhouses. In subsequent plantings from a trace to 5% (average 0.5%) loss occurred in all of the greenhouses. -- C. T. Gregory and R. C. Baines.

Sclerotinia sclerotiorum (drop). In occasional greenhouses a few infected plants were observed during December. -- R. C. Baines and C. T. Gregory.

Brown blight ? (virus disease). Lettuce in 2 greenhouses at Indianapolis and in 1 at Evansville showed from a trace to 3% infection with a transmissible virus disease (R. W. Samson, PDR 28(6): 203, Mar. 15, 1944) that produces symptoms somewhat similar to the brown blight disease described by I. C. Jagger (Phytopath. 30: 53-64, 1940). The affected plants usually were not marketable. -- R. C. Baines, C. T. Gregory, and R. W. Samson.

Aster yellows (virus). An occasional infected plant was found in a greenhouse near Evansville. -- R. C. Baines

Mosaic (virus). Usually from 1 to 5% of the plants in greenhouses are infected with mosaic. However, the value of the infected plants was not lowered and the disease apparently caused no loss. -- C. T. Gregory and R. C. Baines.

LYCOPERSICON ESCULENTUM, TOMATO

Alternaria solani (stem canker and early blight). Stem cankers on recently transplanted tomatoes caused approximately 2% reduction in stand and yield. Frequent rains during May and June in Indiana delayed planting and favored the development of this disease on the young plants. The delayed planting in Indiana necessitated, in many cases, the growing of the seedling for a longer time in the plant fields in the southern States under crowded plant conditions, which are usually favorable for the development of collar rot or stem cankers.

During the growing season early blight caused appreciable defoliation in many fields and reduced the yield for the State about 3%. -- R. W. Samson and R. C. Baines.

Cladosporium fulvum (leaf mold) occurred in traces in about half of the greenhouses in Indiana. -- C. T. Gregory.

Colletotrichum phomoides (anthracnose). During August and September anthracnose of ripe, field-grown fruit was particularly abundant in central and northern Indiana. The loss of fruit and the reduction in quality of the fruit produced amounted to about 2% for the State. -- R. W. Samson and R. C. Baines.

Corynebacterium michiganense (bacterial canker) occurred in traces in a few fields. The almost exclusive use of certified seed for the production of plants for the commercial canning acreage has greatly reduced the prevalence of this seed-borne disease. -- R. W. Samson and R. C. Baines.

Fusarium oxysporum f. lycopersici (fusarium wilt). In occasional fields from 30 to 40% of the plants were affected with wilt. The average loss in yield caused by this disease in field-grown tomatoes in Indiana is estimated at 2%.

In greenhouses fusarium wilt resulted in losses up to 25% with an estimated average loss of 1%. -- C. T. Gregory and R. C. Baines.

Phytophthora parasitica (buckeye rot). A trace of fruit was affected by buckeye rot during 1943. In a few cases it caused from 30 to 40% loss of fruit in victory garden plantings. -- R. C. Baines and R. W. Samson.

Pseudomonas solanacearum (bacterial wilt) was particularly prevalent on late-planted transplants, which had been grown in the southern States (see Alternaria solani). The percentage of plants infected ranged from a trace to 60% and the average loss for the State was 0.5%. -- R. W. Samson.

Septoria lycopersici (leaf spot). A severe epiphytotic occurred generally in Indiana, except for the dry southwestern corner of the State. During August and September tomatoes were defoliated 50 to 90%, and it was estimated that the yield and value of the fruit in the State was reduced 20%. -- R. C. Baines and R. W. Samson.

Xanthomonas vesicatoria (bacterial spot). In central and northern Indiana the bacterial spot disease occurred on leaf-stems and fruit in approximately 1/3 of the fields. The estimated average loss in yield for the State was 1%. -- R. C. Baines and R. W. Samson.

Heterodera marioni (rootknot). A trace of rootknot occurred on tomatoes in a few fields. The transplants used in these fields had been

grown in the southern States. -- R. W. Samson.

In occasional greenhouses nematodes caused from 3 to 4% loss in yield. The estimated average loss of greenhouse-grown tomatoes was 0.1%. -- C. T. Gregory.

Aster yellows (virus). A trace of the tomato plants in a few fields were infected with what is thought to be aster yellows. -- R. W. Samson and R. C. Baines.

Mosaic (virus), in field-grown tomatoes caused an average loss of 0.5% in yield for the State. -- R. W. Samson and R. C. Baines.

Between 30% and 50% of the plants of the spring crop in most greenhouses in Indiana were infected with mosaic. The average estimated loss in yield was 5%. -- C. T. Gregory.

Single-virus streak (virus). In one greenhouse establishment near Terre Haute 80% of the early winter crop were infected severely with single-virus streak (caused by a strain of the tobacco mosaic virus) and the yield evidently was reduced from 10 to 15% in this house. -- R. C. Baines, C. T. Gregory, and R. W. Samson.

PHASEOLUS LUNATUS, LIMA BEAN

Xanthomonas phaseoli (bacterial blight) was prevalent on lima beans and frequently about 10% of the foliage was blighted. The reduction in yield was probably 3 to 4%. -- C. T. Gregory and R. C. Baines.

PHASEOLUS VULGARIS, GREEN BEANS

Fusarium solani f. phaseoli (root rot). In many garden plantings fusarium root rot caused a slight reduction in stand. The decrease in yield during 1943 was estimated to be 0.2%. -- C. T. Gregory and R. C. Baines.

Xanthomonas phaseoli (bacterial blight) caused severe loss in yield of an occasional garden planting; however, the average loss in yield was a trace. -- R. C. Baines and C. T. Gregory.

RAPHANUS SATIVUS, RADISH

Aphanomyces raphani (black root). Radishes in the vicinity of Lafayette frequently were affected severely. -- R. C. Baines.

Pellicularia filamentosa (Corticium vagum) (stem rot). In greenhouses near Indianapolis, radishes were infected slightly. -- C. T. Gregory.

SOLANUM MELONGENA, EGGPLANT

Verticillium albo-atrum (wilt). In a few plantings from 50 to 90% of the plants were infected. The loss for the State was estimated to be 1% of the yield. -- R. C. Baines and C. T. Gregory.

SOLANUM TUBEROSUM, POTATO

Actinomyces scabies (scab). Between 15 and 70% (average 33%) of the potatoes grown on muck soil were affected by scab and approximately 4% of the tubers were infected severely (culls). It is estimated that the reduction in grade and loss of marketable potatoes amounted to 6% of the of the value of the crop. -- R. C. Baines and R. W. Samson.

Alternaria solani (early blight) was prevalent during the summer in

most fields but did not result in appreciable infection and defoliation until fall. The yield was reduced about a trace. -- R. W. Samson and R. C. Baines.

Corticium. See Pellicularia.

Erwinia carotovora (bacterial soft rot) caused a trace of loss when the potatoes were graded soon after digging. -- R. W. Samson and R. C. Baines.

Pellicularia filamentosa (Corticium vagum) (stem rot) was favored by the cool wet weather following planting in the spring, and caused about 2% loss in stand. -- R. W. Samson.

Phytophthora infestans (late blight) was prevalent on the foliage in all late-maturing fields in northern Indiana. In a few fields the vines were blighted severely. However, the dry weather and soil during September appeared to be unfavorable for the infection of the tubers and the development of rot. In a few late fields from 1 to 8% of the tubers were rotted. The estimated average loss from late blight in Indiana was 0.2%. -- R. C. Baines and C. T. Gregory.

Viruses (all viruses but chiefly leaf roll and spindle tuber). From a trace to 1 to 2% of the plants were usually infected. The estimated average loss for the State was 0.2%. -- R. W. Samson.

DISEASES OF CEREALS, GRASSES, AND FORAGE CROPS

AVENA SATIVA, SPRING OATS

Spring oats in Indiana generally were infected severely with Puccinia coronata (crown rust), which reduced the yield about 10%. Pyrenophora avenae (Helminthosporium avenae) (leaf blotch) was of general occurrence in Indiana. Usually infection was slight. It was estimated that leaf blotch resulted in an average reduction in yield of 0.5%. Ustilago avenae (loose smut) and U. kolleri (covered smut) occurred in most fields to some extent, and usually about 0.5% of the panicles were smutted. It is estimated that the average reduction in yield was 0.5%. -- R. M. Caldwell.

HORDEUM VULGARE, WINTER BARLEY

Gibberella zeae (scab). Barley, which is grown chiefly in the southern half of Indiana, usually was infected slightly with G. zeae. The average estimated loss in yield from scab was 5%. -- R. M. Caldwell

Puccinia anomala (leaf rust). Barley was affected slightly with leaf rust, and the yield was reduced a trace as a result of this disease. -- R. M. Caldwell.

Puccinia graminis var. tritici (stem rust). A trace occurred on barley and no apparent loss in yield resulted from this disease. -- R. M. Caldwell.

Ustilago jensenii (covered smut). A trace of infection resulted in a trace reduction in yield. -- R. C. Baines.

Ustilago nigra and U. nuda (loose smut) generally occurred in moderate infections which reduced the yield approximately 2%. -- R. M. Caldwell.

MEDICAGO SATIVA, ALFALFA

Pseudomonas medicaginis (bacterial wilt). From 10 to 20% of the alfalfa plants in a number of fields in northwestern Indiana were infected and killed. The actual loss in hay was minimized by the cultural practice of interplanting the alfalfa with timothy or some other "hay" grass. -- M. O. Pence.

Pseudopeziza medicaginis (leaf spot) was abundant on the first cutting throughout the State and on the second cutting in northern Indiana. The estimated reduction in yield of the first cutting was 5 to 10%. -- R. C. Baines.

* (Secale cereale, see below).

SOJA MAX, SOYBEAN

Cercospora sojina (C. daizu) (frog-eye leaf spot) was prevalent in central and southcentral Indiana. In this area from 70 to 100% of the leaves in a quarter of the fields were infected severely and the yield was reduced about 10%. A trace was observed in northern Indiana. Southwestern Indiana was unusually dry and soybeans were nearly free from leaf spot diseases. The loss in yield from "frog-eye" for the State is estimated at a trace. -- R. C. Baines and C. T. Gregory.

Cercosporina kikuchii (purple spot of soybean seed). From 1 to 3% of the soybeans in occasional fields in central and northern Indiana were affected severely with the purple spot disease. There was no apparent crop loss. -- R. C. Baines.

Diaporthe sojae (pod and stem blight). Very little of this disease was observed in 1943. A trace was found in a few fields at harvest, but no significant loss resulted. -- R. C. Baines and C. T. Gregory.

Fusarium oxysporum f. tracheiphilum (wilt) was observed in 2 fields, and apparently this disease at present is not widespread in Indiana. In Shelby County 10% of the plants of the Manchu variety in a small variety planting were killed prematurely and about 0.5% of the plants in a 20-acre field in Hendricks County were killed. The loss for the State was a trace. -- C. T. Gregory and R. C. Baines.

Glomerella glycines (anthracnose). During September a trace developed, chiefly on the stems, in most fields, but the disease resulted in little or no damage as the plants were nearly mature at the time of its appearance. -- R. C. Baines and C. T. Gregory.

Peronospora manshurica (downy mildew) occurred in about 60% of the soybean fields examined. Infection was especially abundant in central and northern Indiana, and sparse in southwestern Indiana. In a few fields between 50 and 100% of the leaves were infected severely. Considerable etiolation of the infected leaf area occurred, but only slight necrosis. The reduction in yield from most fields was a trace; however, in occasional fields it appeared that the yield was reduced by 2 to 3% at least. -- R. C. Baines and C. T. Gregory.

Sclerotium bataticola (charcoal rot). A trace was found in one field in Sullivan County by C. T. Gregory.

Xanthomonas phaseoli var. sojense (bacterial pustule or blight). The bacterial pustule or blight disease was very prevalent on soybeans in central and northern Indiana, while in southwestern Indiana soybeans were free from or affected by only a trace of this disease. Approximately 5%

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*SECALE CEREALE, RYE

A trace of Claviceps purpurea (ergot) occurred in 1943. Generally rye was infected slightly with Puccinia rubigo-vera var. secalis (leaf rust), and a trace resulted. -- R. M. Caldwell.

of the fields were nearly free from infection, 45% were affected slightly, 30% moderately, and 20% severely. In the fields classed as moderately affected from 40 to 90% of the leaves usually showed moderate infections, while in fields that were severely affected from 60 to 90% of the leaves showed severe infection.

This disease induced little or no defoliation of the varieties grown in Indiana, but caused considerable yellowing and necrosis of the infected leaf area. In the moderately affected fields the yield probably was reduced 1 to 5%, and in severely affected fields from 5 to 10%. Thus, the yield for the State was reduced 3 to 4% by this disease. -- R. C. Baines and C. T. Gregory.

Mosaic (virus). A trace of mosaic was found in occasional fields. -- R. C. Baines and R. W. Samson.

Streak or bud blight (virus). This disease is caused by the tobacco-ringspot virus or a virus that has somewhat similar properties. The disease causes the abscission of blossoms and young pods, the blasting of beans in the pod, brown blotches and streaks on the pod, mosaic symptoms on the young leaves, and usually dark streaks in the pith of the internodes. Plants infected when still young mature few or no beans.

R. W. Samson observed this disease on vegetable soybeans in Indiana in 1941. He determined that the disease was caused by the tobacco-ringspot virus (PDR 26(17): 382, Sept. 15, 1942). In 1942, Folke Johnson observed the disease on field soybeans in Ohio, and confirmed the identification of the causal virus (PDR 27(2):86-87, Feb. 1, 1943). During 1943, from a trace to 1% of the plants in many fields were infected with streak in Indiana. In occasional fields from 5 to 10% of the plants were infected. The yield from infected plants ranged from none at all to 60% of that from healthy plants, depending presumably on the stage of maturity of the plant at the time of infection.

At this time not very much is known regarding the sources of infection and the mode and rate of spread of the disease in soybean fields. The development of this disease should be followed closely in the future and, if necessary, measures taken to prevent any serious spread or increase. -- R. C. Baines and C. T. Gregory.

SORGHUM VULGARE var. SUDANENSE, SUDAN GRASS

Helminthosporium turcicum (leaf blight). Sudan grass was severely infected and it was estimated that the feed value was reduced 30 to 40%. -- R. C. Baines.

TRIFOLIUM PRATENSE, RED CLOVER

Cercospora zebrina (leaf spot). Red clover generally was infected moderately to severely with C. zebrina. The average reduction in yield and quality of hay was estimated at 10%. -- R. C. Baines.

TRITICUM AESTIVUM, WINTER WHEAT

Gibberella zeae (scab) occurred in epidemic severity on wheat in Indiana in 1943. Wheat in the southern half of the State was infected severely and in a few fields a 50% loss in yield resulted. In the northern half wheat was affected slightly to moderately and losses ranged from 1 to

21% (average 10%) of the grain. The average loss in yield and grade of wheat due to scab was estimated to be 17% for the State. -- R. M. Caldwell and R. C. Baines.

Puccinia graminis var. tritici (stem rust). A trace of infection and loss occurred in south-central Indiana. -- R. M. Caldwell.

Puccinia rubigo-vera var. tritici (leaf rust) was moderate and generally distributed over Indiana. The average loss in yield and quality was estimated to be 5% for the State. -- R. M. Caldwell.

Septoria nodorum (glume blotch). Slight infection occurred in local fields of wheat in southern Indiana. The loss was a trace. -- R. M. Caldwell.

Septoria tritici (speckled leaf blotch). Slight, fairly general infection occurred in Indiana in 1943. This disease was more prevalent than usual and caused a trace of loss. -- R. M. Caldwell.

Tilletia foetida (T. levis) (bunt). A slight amount of infection by bunt occurred in occasional fields; the resultant loss was a trace reduction in yield. -- R. M. Caldwell.

Ustilago tritici (loose smut) occurred generally over the State and caused an estimated average loss of 5% in yield. -- R. M. Caldwell.

A root rot of undetermined cause occurred in occasional fields and was serious especially in wet areas. The estimated loss was 1%. -- R. M. Caldwell.

A trace of wheat mosaic (virus) occurred in limited and local areas. -- R. M. Caldwell.

ZEA MAYS, CORN

Bacterium stewartii (bacterial leaf blight). Nearly all of the corn fields in Indiana were affected slightly or moderately with bacterial leaf blight. An occasional field was affected severely. It was estimated that losses ranged from a trace up to 1% in severely affected fields. -- R. C. Baines and A. J. Ullstrup.

Diplodia zeae (ear rot and stalk rot). Diplodia ear rot was less prevalent than normal. Between 1 and 3% of the ears in 16% of the fields were infected. The estimated loss in yield for the State from this rot was 0.2%.

Diplodia stalk rot was found in all of the fields examined and between 1 and 65% (average 27%) of the stalks were infected severely. This disease occurred late when the corn was dented well. In a few fields infection occurred when the grain was immature and caused a slight reduction in yield. -- R. C. Baines and A. J. Ullstrup.

Gibberella fujikuroi (fusarium ear rot) occurred in 84% of the fields. Between 1 and 9% (average 2.8%) of the ears were infected slightly. The loss in sound grain from this rot was estimated at a trace. -- R. C. Baines and A. J. Ullstrup.

Gibberella zeae (Gibberella ear rot) was more prevalent than average and was distributed generally over the State. From 1 to 4% of the ears in 40% of the fields were infected. Approximately 0.8% of all the ears were infected with G. zeae, which resulted in about 0.4% reduction in sound corn.

It appears likely that the increase in Gibberella ear rot over other

years was caused by the abundance of inoculum from scabby grain fields.-- R. C. Baines and A. J. Ullstrup.

Helminthosporium turcicum (leaf blight) was very severe on corn in the east-central area of Indiana, and this area of severe infection was larger than in 1942. Local fields in central and northern Indiana also were infected severely. Severely blighted leaves were killed prematurely and resulted in many chaffy ears; also, there was appreciable reduction in the quantity and quality of fodder. No accurate estimates of decreases in the yield of grain were obtained; however, it is believed that leaf blight in severely infected fields reduced the yield by 10%, and for the State 0.5% loss is probable. -- A. J. Ullstrup and R. C. Baines.

Hormodendron sp. (kernel rot). In occasional fields a black rot of individual grains, caused by Hormodendron sp., occurred. There was no appreciable loss in yield from this disease. -- R. C. Baines and A. J. Ullstrup.

Nigrospora sphaerica (cob rot) occurred in 12% of the fields examined and caused only a trace of reduction in yield for the State. -- R. C. Baines.

Penicillium spp. (ear rot). Penicillium rot nearly always followed earworm injury and caused a trace of loss in most fields. -- R. C. Baines.

Physalospora zeae Stout (leaf and stalk rot). Sparse lesions caused by P. zeae occurred on leaves and at the bases of the tassels in occasional fields in the southern half of Indiana. The imperfect stage, Macrophoma zeae Tehon & Daniels, was found associated with the perithecia of P. zeae. There was no appreciable loss from this disease. -- A. J. Ullstrup and R. C. Baines.

Physoderma zeae-maydis (brown spot). Corn in the Ohio drainage area was infected slightly to moderately with P. zeae-maydis, but there was no appreciable damage. -- A. J. Ullstrup and R. C. Baines.

Puccinia sorghi (rust). Occasional scattered fields throughout Indiana were infected slightly to moderately. No apparent loss in yield resulted. -- R. C. Baines.

Ustilago maydis (smut) was much less prevalent than normal and caused no appreciable loss. The maximum percentage of infected plants in a field was 3. -- R. C. Baines and A. J. Ullstrup.

Seedling blights (caused by Diplodia zeae, Fusaria, etc.), caused no important losses during 1943. Corn planting was delayed because of wet weather during May and the seed germinated and grew rapidly when planted.

Corn was injured severely by root worm in scattered areas of the State and the injured plants frequently were affected by an undetermined bacterial stalk rot. There appeared to be a close relationship between the insect injuries and the stalk rot. -- A. J. Ullstrup.

DISEASES OF FRUIT CROPS

AMYGDALUS PERSICA, PEACH. In southern Indiana an occasional fruit affected with brown-rot (Monilinia fructicola) was observed. The dry weather during July and August apparently was unfavorable for the development of this disease. A trace of leaf-curl (Taphrina deformans) occurred. In most orchards from slight to moderate bacterial spot (Xanthomonas pruni)

developed on the fruit and leaves and caused a trace of loss in the State. -- R. C. Baines.

FRAGARIA, STRAWBERRY. Mycosphaerella fragariae (leaf-spot). Strawberries in Indiana generally were infected slightly to moderately. Occasional commercial fields of strawberries were infected moderately with Phytophthora fragariae (red stele) and a number of home garden plantings were infected severely. Severely infected plants produced few or no strawberries. -- R. C. Baines.

MALUS SYLVESTRIS, APPLE. Glomerella cingulata (bitter-rot). During July and August a few apples affected with bitter rot were observed in a few orchards in southern Indiana. This disease did not increase during August and September, evidently because of unfavorable moisture conditions. The loss was a trace.

Gloeodes pomigena (sooty blotch). A trace to 1% of the apples were affected moderately with sooty blotch in a few orchards in southern Indiana. There was no appreciable loss.

Gymnosporangium clavipes (G. germinale) (Schw.) Kern (quince rust). A trace of Delicious apples infected severely with quince rust were observed in a few orchards in southern Indiana.

Gymnosporangium juniperi-virginianae (apple rust). From a trace to 5% of the leaves and fruit were infected with the apple rust fungus in orchards in central and southern Indiana. The loss of fruit in the State from this disease was a trace.

Helminthosporium papulosum (black pox). In one orchard near Seymour, Indiana, Grimes Golden apples on a number of old trees were infected severely with Helminthosporium papulosum.

Phyllosticta solitaria (blotch). In a number of orchards in southern Indiana Dutchess apples were infected severely. The loss in grade and quality was estimated to have amounted to 3% of the value of the crop.

Physalospora obtusa (black-rot, frog-eye). On apples in Indiana frog-eye leaf-spot was of general occurrence. Infection ranged from a trace to slight and apparently caused a slight reduction in yield. A trace of fruit infected with P. obtusa was observed in all of the orchards examined.

Venturia inaequalis (scab). Scab infection of apples was more severe in 1943 than during the past 4 years. The climatological conditions during the spring were favorable for the epiphytotic development of this disease in many orchards. Fruit infected with scab ranged from a trace to 100%. The differences in the degree of scab infection in the orchards appears to be caused chiefly by differences in the amounts of primary ascosporic inoculum, and the timeliness and thoroughness that the applications of fungicides were made. It is estimated that scab caused a 10% loss of crop and a 10% loss in grade or value, total loss 20%. -- R. C. Baines.

PRUNUS AVIUM, SWEET CHERRY. Coccomyces hiemalis (leaf-spot). caused severe defoliation. -- R. C. Baines.

PRUNUS CERASUS, SOUR CHERRY. Coccomyces hiemalis (leaf-spot). Sour cherry trees were severely defoliated by C. hiemalis. -- R. C. Baines.

PRUNUS spp., PLUM. Plums in Greene and Lawrence Counties were infected severely with C. prunophorae (leaf spot) and defoliated moderately.

Xanthomonas pruni (bacterial spot) was severe on hybrid (European x Americana) plums near Lafayette. -- R. C. Baines.

RIBES SATIVUM, RED CURRANT. Mycosphaerella grossulariae (leaf spot). Currant leaves in Tippecanoe County were infected moderately with slight defoliation resulting. -- R. C. Baines.

RIBES UVA-CRISPA, GOOSEBERRY. Mycosphaerella grossulariae (leaf spot). Gooseberries in Tippecanoe County, Indiana, were defoliated severely and the yield and quality reduced possibly 10%. -- R. C. Baines.

RUBUS sp., RASPBERRY. Elsinoë veneta (anthracnose). During 1943, the new raspberry canes were infected severely with anthracnose. It is estimated that this disease caused a 5% loss in crop. -- R. C. Baines.

Sphaerulina rubi (leaf-spot). Raspberries in Indiana were infected severely with S. rubi and frequently were nearly defoliated in September. The crop is estimated to have been reduced 5 to 10% by this disease. -- R. C. Baines.

Non-parasitic, low winter temperature. During the winter of 1942-1943 raspberry canes were injured severely by low temperatures. In many cases the injured canes produced new leaves, blossomed, and then died before the berries matured. The injured canes frequently were infected by Leptosphaeria coniothyrium. The loss of crop was estimated at 30 to 50% (average 40%). -- R. C. Baines.

VITIS LABRUSCA, GRAPE. Guignardia bidwellii (black-rot). Grapes that were not thoroughly sprayed were infected moderately to severely with G. bidwellii. The losses ranged from a trace to 40% (average 10%).-- R. C. Baines.

DISEASES OF SPECIAL CROPS

BETA VULGARIS, SUGAR BEET. Cercospora beticola (leaf spot) was common on sugar beets in northeastern Indiana and between 50 to 60% of the leaves were infected severely. The loss in yield is estimated at 10%. -- R. C. Baines.

MENTHA PIPERITA, PEPPERMINT. Peppermint on the muck soils in northern Indiana was infected from a trace to severely with Sphaceloma menthae (anthracnose). The yield of oil-of-peppermint from the occasional severely infected fields was reduced approximately 50%, and the average reduction was estimated at 5%. -- R. C. Baines.

MENTHA SPICATA, SPEARMINT. The second growth of the "Scotch" variety of spearmint generally was infected severely with Puccinia menthae (rust) in northern Indiana. The infection developed too late to affect the yield of oil from the first cutting appreciably, but evidently weakened the plants seriously and thus rendered them more susceptible to cold injury during the winter.

Severe infection with Sphaceloma menthae developed on the second growth of the "scotch" variety in about 75% of the fields in northern Indiana. -- R. C. Baines.

DISEASES OF ORNAMENTALS

ANTIRRHINUM MAJUS, SNAPDRAGON. Phyllosticta antirrhini (leaf spot) occurred in an occasional greenhouse and caused a trace of injury. Snapdragons in most greenhouses were affected with a trace or slight amounts of Puccinia antirrhini (rust), which caused no appreciable loss. -- C. T. Gregory.

Verticillium albo-atrum . (wilt). In occasional greenhouses in Indiana 5 to 10% of the plants were infected with Verticillium albo-atrum. The loss for the State was a trace. -- C. T. Gregory.

CHRYSANTHEMUM spp., CHRYSANTHEMUM. In occasional plantings out-of-doors 50% of the plants were infected severely by Aphelenchus sp. (foliar nematode). -- C. T. Gregory.

Septoria chrysanthemella (leaf spot). Frequently from 5 to 10% of plants outdoors were moderately infected. However, there appeared to be only a trace of damage. -- C. T. Gregory and R. C. Baines.

Verticillium albo-atrum (wilt). From 0.5 to 10% of the plants frequently were infected. The average loss was about 1%. -- C. T. Gregory.

DIANTHUS CARYOPHYLLUS, CARNATION. Between 2 and 20% (average 5%) of the plants in a few greenhouses were infected by Fusarium sp. (branch rot). The estimated loss for the State was 1%. From 1 to 10% of the plants in greenhouses were affected by Pellicularia filamentosa (Corticium vagum) causing stem rot, and the estimated average loss was 2%.

Uromyces caryophyllinus (rust) affected between a trace and 10% of greenhouse plants, mostly in moderate infections. The loss in the State from rust was a trace. -- C. T. Gregory.

GLADIOLUS spp., GLADIOLUS. Varieties such as Picardy appeared to be especially susceptible to corm rot caused by Fusarium oxysporum f. gladioli. From a trace to 20%, average 0.5%, of the corms were infected. -- R. C. Baines and C. T. Gregory.

A trace of scab caused by Pseudomonas marginata was observed by C. T. Gregory.

LATHYRUS ODORATUS, SWEET PEA. Occasional greenhouse plantings of sweet peas were infected slightly by Erysiphe polygoni (powdery mildew) which caused a trace of loss. Rhizoctonia solani (root rot) occurred frequently on sweet peas in greenhouses and usually reduced the stand by 10%. -- C. T. Gregory.

PELARGONIUM spp., GERANIUM. Botrytis cinerea (gray mold) occurred commonly on geraniums in greenhouses and caused a trace of loss. Pseudomonas erodii (bacterial leaf spot) was prevalent on geraniums in green-

houses. From a trace to 100% of the plants were infected moderately. The average loss in value of the plants was estimated to be from 1 to 2%. -- C. T. Gregory.

PHLOX spp., PHLOX. Erysiphe cichoracearum (powdery mildew) was prevalent on phlox and impaired the ornamental value of this plant. -- R. C. Baines.

ROSA spp. cult., ROSE. Roses in all of the greenhouses examined were infected slightly to moderately with Diplocarpon rosae (black spot). It was estimated that the disease caused an average loss of 2%. Leptosphaeria coniothyrium (cane blight) occurred in most greenhouses and from 2 to 10% (average 4%) of the canes were killed. Sphaerotheca humuli (powdery mildew) occurred in traces in all greenhouses but caused no apparent loss. However, rambler roses outdoors were infected severely. -- C. T. Gregory.

TULIPA spp., TULIP. Botrytis tulipae (botrytis blight) was of general occurrence and caused 1 to 2% loss. -- R. C. Baines and C. T. Gregory.

PLANT DISEASES AND RESULTING CROP LOSSES IN ILLINOIS, 1943

R. C. Baines

This report was prepared in collaboration with G. H. Boewe of the Illinois State Natural History Survey, Section of Applied Botany and Plant Pathology; H. W. Anderson, A. S. Colby, Benjamin Koehler, M. B. Linn, and D. Powell, of the Illinois Agricultural Experiment Station; and W. B. Allington, of the Division of Forage Crops and Diseases, U. S. Bureau of Plant Industry, Soils, and Agricultural Engineering. Specific recognition for the information presented is made by name under each disease.

DISEASES OF VEGETABLE CROPS

ALLIUM CEPA, ONION

Phoma terrestris (pink root rot) appeared to be of general occurrence on onions in northern Illinois. Frequently from 5 to 30% of the roots were infected. The crop loss resulting was estimated to have been 1 to 2%. Very little infection by Urocystis cepulae (smut) developed on young onions in northern Illinois. Seed treatment appears to be effective in controlling this disease and generally is used. -- M. B. Linn.

BETA VULGARIS, BEET

Cercospora beticola (leaf spot) was of general occurrence, usually in moderate amounts. It appeared to cause a 4 to 5% average loss in yield. -- M. B. Linn and R. C. Baines.

BRASSICA OLERACEA var. CAPITATA, CABBAGE

Fusarium oxysporum f. conglutinans (yellows). In a few fields in northern Illinois about 30% of the plants were infected severely and failed to mature marketable heads. The average loss in the State from yellows was about 1%, according to M. B. Linn.

Phoma lingam (black leg). A half-acre field near Peoria was a complete

loss due to black leg. The average loss caused in the State was a trace. -- R. C. Baines and M. B. Linn.

CAPSICUM FRUTESCENS, PEPPER

Fusarium sp. (wilt). In an acre planting near Sterling, approximately 5% of the bell pepper plants were affected severely. The loss in this field from wilt amounted to about 5%. For the State it was a trace. -- M. B. Linn and R. C. Baines.

Xanthomonas vesicatoria (bacterial spot). Fruit and leaves of bell peppers in a 3-acre field near Rock Falls were slightly affected. The loss from this disease appeared to be a trace. -- R. C. Baines and M. B. Linn.

Tobacco mosaic (virus). Approximately 5% of the bell pepper plants in a 3-acre planting near Rock Falls were infected moderately with the tobacco-mosaic virus. The loss in this planting amounted to about 3%; for the State it was a trace. -- M. B. Linn and R. C. Baines.

Blossom-end rot (physiogenic) occurred in all pepper plantings examined, and resulted in an estimated 5% loss for the State. -- R. C. Baines and M. B. Linn.

CICHORIUM ENDIVIA, ENDIVE

Between 3 and 5% of the plants in a 1/5-acre planting near Peoria were infected severely with aster yellows (virus). The loss for the State was a trace. -- M. B. Linn and R. C. Baines

CITRULLUS VULGARIS, WATERMELON

Colletotrichum lagenarium (anthracnose). Moderate to severe infection of the leaves caused appreciable defoliation in most plantings. The average loss caused by anthracnose in Illinois was between 5 and 10%.

Fusarium oxysporum f. melonis (wilt). In a few fields near Havana and Thomas, from 25 to 90% of the vines were severely affected or killed by wilt. The average crop loss from wilt in Illinois was 10%.

Pythium sp. (blossom-end rot) occurred in all of the fields examined and the estimated average loss was 10%. -- R. C. Baines and M. B. Linn.

CUCUMIS MELO, CANTALOUP

Fusarium oxysporum f. melonis (wilt). In a 5-acre field near Havana approximately 2% of the plants were infected severely or killed by wilt. The average loss in the State was a trace. -- R. C. Baines and M. B. Linn.

CUCUMIS SATIVUS, CUCUMBER

Erwinia tracheiphila (bacterial wilt) was of general distribution in Illinois and caused an estimated average loss of 3 to 5% in yield. -- M. B. Linn.

CUCURBITA PEPO var. CONDENSA, SUMMER SQUASH

Choanephora cucurbitarum (blossom blight and fruit rot). In a garden near Urbana, occasional young squash fruits were rotted by this organism, according to M. B. Linn.

DAUCUS CAROTA, CARROT

From a trace to slight infection with Alternaria carotae (leaf blight) occurred in most carrot plantings, and a trace of Cercospora carotae (leaf blight) occurred in occasional plantings. In a few fields in Cook County 30% of the plants were infected with the aster yellows virus; the yield in these fields was reduced from 1 to 2%. -- M. B. Linn

IPOMOEA BATATAS, SWEETPOTATO

Actinomyces sp. (pox or soil rot). Slight infection of from a trace to 10% of the sweetpotatoes was noted in occasional fields. Average yield and grade was reduced a trace. -- R. C. Baines.

Ceratostomella. See Endoconidiophora.

Endoconidiophora fimbriata (Ceratostomella fimbriata) (black rot). Sweetpotatoes in a few fields at the time of digging showed from a trace to slight amounts of black rot. However, in storage houses during December a few lots contained 30 to 60% of the roots severely affected, and about 10% of the lots contained from 4 to 6% of affected roots. The estimated average loss from black rot was about 1%. -- R. C. Baines.

Fusarium oxysporum f. batatas. (Stem rot or wilt) occurred in half of the sweetpotato fields in southern Illinois. In occasional fields in Union County 30% of the plants were infected severely or killed. In about 10% of the fields, from 10 to 15% of the plants were infected severely; and in 20% of the fields less than 1% of the plants were infected. -- R. C. Baines and G. H. Boewe.

Fusarium surface rot affected from a trace to 0.5% of the sweetpotato lots examined in storage houses during the latter part of December. -- R. C. Baines.

Monilochaetes infuscans (scurf). A few affected roots were found in a field in Union County. -- R. C. Baines.

Pythium ultimum (ring rot) caused losses in storage houses ranging from 0.5 to 5% and averaging about 1%. -- R. C. Baines.

Rhizopus nigricans (soft rot) affected from a trace to 1% of the stored sweetpotatoes. -- R. C. Baines.

Sclerotium bataticola (charcoal rot) was found on occasional sweetpotatoes in storage. -- R. C. Baines.

Mosaic (virus). Most fields were free from mosaic. A few infected plants were found in one field in Union County. -- R. C. Baines.

LACTUCA SATIVA, LETTUCE

Approximately 5% of the lettuce plants in an outdoor planting near East St. Louis were infected with aster yellows (virus). -- M. B. Linn.

LYCOPERSICON ESCULENTUM, TOMATO

Alternaria solani (early blight). Tomatoes in most plantings were affected slightly with the leaf spot, which caused a trace of reduction in yield. -- R. C. Baines and M. B. Linn.

Cladosporium fulvum (leaf mold). Tomatoes in a greenhouse near Sterling were moderately infected, with about 2% loss in yield. -- M. B. Linn.

Colletotrichum phomoides (anthracnose) was moderately prevalent during August and September on ripe field-grown fruit. Loss of fruit and re-

duction in quality was estimated to be between 1 and 2%. -- R. C. Baines and M. B. Linn.

Corynebacterium michiganense (bacterial canker). Very few tomatoes affected with bacterial canker were observed in Illinois during 1943. -- M. B. Linn.

Fusarium oxysporum f. lycopersici (wilt) was especially serious in market-garden plantings of tomatoes, and between 10 and 30% of the plants were infected severely. In the acreage planted for canning about 1% of the plants were affected severely and produced little or no fruit. In a greenhouse near Bloomington approximately 30% of the spring crop was lost as a result of fusarium wilt. -- R. C. Baines and M. B. Linn.

Phytophthora parasitica (buckeye rot) affected 20% of the fruit on the first clusters to ripen in occasional early plantings. The loss for the State was a trace. -- M. B. Linn.

Septoria lycopersici (leaf spot) caused moderate to severe defoliation during August and September in central and northern Illinois. The average loss in yield was estimated at 5%. -- R. C. Baines and M. B. Linn.

Aster yellows (virus). An occasional tomato plant was infected with aster yellows during 1943. -- M. B. Linn and R. C. Baines.

Mosaic (virus). Tomatoes grown in the field and in greenhouses frequently were infected with mosaic. This disease was very prevalent on tomatoes in victory gardens. The average loss in yield is estimated at 1%. -- M. B. Linn and R. C. Baines.

In occasional greenhouses between a trace and 1% of the tomato plants were infected with the cucumber mosaic virus. -- M. B. Linn.

Leaf roll (physiogenic). Tomato plants in victory gardens, and especially staked plants, frequently were affected severely with this non-parasitic disease according to M. B. Linn.

PHASEOLUS LUNATUS, LIMA BEAN

Corticium. See Pellicularia.

Fusarium solani f. phaseoli (root rot) occurred in traces in most lima bean plantings. -- M. B. Linn

Fusarium sp. (pod rot). In commercial fields in northern Illinois between 1 and 2% of the pods that were in contact with the soil were rotted by Fusarium sp. -- M. B. Linn and R. C. Baines.

Pellicularia filamentosa (Corticium vagum). A few plants were infected and killed in most plantings. -- M. B. Linn.

Xanthomonas phaseoli (bacterial blight) caused 100% loss in a 30-acre field of lima beans grown for canning in northern Illinois. The average estimated loss for the State is 10%. -- M. B. Linn and R. C. Baines.

Mosaic (virus) infected a few plants in most plantings, but no appreciable loss resulted. -- M. B. Linn and R. C. Baines.

PHASEOLUS VULGARIS, GREEN BEANS

Fusarium solani f. phaseoli (root rot). Serious losses from root rot were rather local although this disease is widely distributed in Illinois. A 5-acre field of early-planted beans near East St. Louis was infected severely and was abandoned. The average loss in the State was a trace. -- M. B. Linn.

Pseudomonas medicaginis var. phaseolicola (halo blight) occurred in traces in occasional plantings of green beans. -- M. B. Linn.

Xanthomonas phaseoli (common bacterial blight) was severe in occasional plantings; however, most plantings were free or showed only a trace. The loss for the State was a trace. -- M. B. Linn and R. C. Baines.

Mosaic (virus). Plantings were free from mosaic or only occasional plants were affected. -- M. B. Linn and R. C. Baines.

PISUM SATIVUM, PEA

Aphanomyces euteiches (root rot) occurred in trace amounts on peas in victory and home gardens. Mycosphaerella sp. (blight; Asochyta leaf and pod spot) occurred in traces in occasional plantings. Seed decay and post emergence damping-off, of undetermined cause, frequently resulted in serious reductions in stand of peas in garden plantings. -- M. B. Linn.

SOLANUM MELONGENA, EGGPLANT

Phomopsis vexans (fruit rot). In a market-garden planting near Rock Falls, 25% of the fruits were infected severely and rotted by P. vexans.-- M. B. Linn and R. C. Baines.

Verticillium albo-atrum (wilt) was of general occurrence in Illinois and from 5 to 100% of the plants usually were infected severely or killed. The average estimated loss from wilt was 40% of the yield. -- R. C. Baines and M. B. Linn

SOLANUM TUBEROSUM, POTATO

Actinomyces scabies (scab). Potatoes in Illinois usually were affected slightly to moderately with scab. -- R. C. Baines, G. H. Boewe, and M. B. Linn.

Erwinia phytophthora (E. atroseptica) (black leg) was especially serious on early-planted potatoes in the East St. Louis area, where the average loss was 5%. The loss for the State was a trace. -- M. B. Linn.

Phytophthora infestans (late blight). During the first half of September the foliage of potatoes in northwestern Illinois frequently was infected slightly to severely with P. infestans. Late blight was especially prevalent in Jo Daviess County and was more prevalent and severe on unsprayed than on sprayed potatoes.

Very little rot developed on the tubers even in fields in which the foliage was moderately infected. The dry weather during the latter part of September and during October evidently was unfavorable for infection of the tubers and the development of rot. -- G. H. Boewe, R. C. Baines, and M. B. Linn.

Leaf roll (virus) frequently affected 30% of the plants when common seed was used. It is estimated that leaf roll caused a reduction of 5% in the yield of potatoes in Illinois. -- M. B. Linn.

Hopperburn (leafhopper). Leafhoppers were very abundant and caused serious damage to potatoes in Illinois. It is estimated that in victory gardens the yield was reduced 50% and in commercial fields 20%, by hopperburn. -- M. B. Linn and G. H. Boewe

DISEASES OF CEREALS AND FORAGE CROPS

AVENA SATIVA, OATS

Puccinia coronata (crown rust) was very prevalent and severe during 1943. By harvest time, 100% of the oat plants were infected, except in fields of resistant varieties. The infection was especially severe in the northern and western counties and in an area in the east-central and south-central part of Illinois. From a trace to 41% (average 14%) of the leaf area of the plants was occupied by the rust pustules. For a more detailed report see PDR 27(17):346-347, 1943.

Puccinia graminis var. avenae (stem rust). Oats generally were affected with a trace to slight amounts of stem rust, which apparently caused an average loss of 1% in yield.

Ustilago avenae (loose smut) occurred in 80% of the 52 fields that were examined in Illinois. From none to 14% (average 3.2%) of the panicles were smutted. The highest level of infection occurred in the 2 tiers of counties across the northern part of Illinois. The average loss in yield from loose smut was about 4%.

Ustilago kolleri (U. levis) (covered smut) occurred in approximately 33% of the 32 fields that were examined and in amounts ranging from a trace to 9% (average 0.6% of the panicles smutted). -- G. H. Boewe.

HORDEUM VULGARE, BARLEY

Puccinia anomala (leaf rust). Barley generally was infected slightly by P. anomala in Illinois during 1943. Between a trace and 7% of the leaf area was affected by rust pustules and 0.5% loss in yield resulted.

Puccinia graminis var. tritici (stem rust) was light and occurred only in the northern 2/3 of the State. It caused no apparent loss in yield of barley in Illinois in 1943.

Ustilago jensenii (U. hordei) (covered smut) occurred only in the southern third of Illinois, the winter barley region. The infection was light and spotty. In one field 3% of the heads were smutted.

Ustilago nuda and other species (loose smut) occurred throughout Illinois in amounts ranging from a trace to 1%. -- G. H. Boewe.

MEDICAGO SATIVA, ALFALFA

Cercospora zebrina (leaf spot) occurred generally, in slight amounts.

Pseudopeziza medicaginis and Pyrenopeziza medicaginis (leaf spots). Usually alfalfa in Illinois was affected slightly to moderately with both of these leaf spot diseases and slight defoliation resulted. -- G. H. Boewe.

SECALE CEREALE, RYE

Puccinia rubigo-vera var. secalis (leaf rust) occurred as slight infections in most fields. Urocystis occulta (stem smut) was not observed in Illinois during 1943. Ustilago tritici (loose smut) apparently did not occur in Illinois during 1943. -- G. H. Boewe.

SOJA MAX, SOYBEAN

Cercospora sojina (C. daizu) (frog-eye leaf spot). Soybeans in occasional fields in southern Illinois were infected slightly or moderately. Only a trace was observed in a few fields north of Urbana. The loss for the State was estimated at a trace. -- G. H. Boewe and W. B. Allington.

Diaporthe sojae (pod and stem blight). At harvest soybeans generally were infected severely with D. sojae. However, infection occurred late in the development of the soybeans and caused slight reduction (0.5%) in yield. -- W. B. Allington, G. H. Boewe, and R. C. Baines.

Glomerella glycines (anthracnose). During the fall soybeans in occasional fields were infected slightly; however, the seeds were well-matured at the time of infection and the yield apparently was not impaired. -- W. B. Allington and R. C. Baines.

Peronospora manshurica (downy mildew). Soybeans in Illinois were affected slightly to moderately with downy mildew. The variety Illini appeared to be very susceptible. The average estimated reduction in yield was a trace. -- W. B. Allington, G. H. Boewe, and R. C. Baines.

Xanthomonas phaseoli var. sojense (pustular spot). All of the standard varieties of soybeans in Illinois were infected slightly to moderately with X. phaseoli var. sojense which very likely caused a 3 to 4% reduction in yield. -- W. B. Allington, G. H. Boewe, and R. C. Baines.

Mosaic (virus) infected from a trace to 2 or 3% of the plants in many fields. -- W. B. Allington and G. H. Boewe.

Streak or bud blight (tobacco ringspot virus) was distributed widely in Illinois. Usually about 1% of the plants were infected, but in occasional fields in central Illinois 50% of the plants showed severe symptoms of this disease and the yield was reduced approximately 25% in these fields. The average estimated reduction in yield from bud blight in Illinois was 1%.

Streak or bud blight is a disease of apparently recent occurrence, which is capable of causing serious crop losses. Occurrence of the virus on soybean was first reported from Indiana in 1941 by R. W. Samson (see above, page 179). During 1943, this disease of soybeans was widespread in Illinois and Indiana. Little is known concerning infection sources or method or rate of dissemination and the disease should be watched closely to prevent possible serious spread. -- W. B. Allington, G. H. Boewe, and R. C. Baines.

Wildfire, a bacterial disease caused by an undetermined organism, occurred in scattered fields over the State. In many fields the infection was slight, and either general or occurring in small local areas. In one field soybeans in a small area were infected severely. The loss from this disease during 1943 was slight. -- W. B. Allington and G. H. Boewe.

TRIFOLIUM PRATENSE, RED CLOVER

Cercospora zebrina (leaf spot) occurred generally in moderate to severe infections, the average reduction in yield and quality of the hay being estimated at 10%. -- R. C. Baines.

TRITICUM AESTIVUM, WHEAT

Gibberella zeae (scab) occurred in epidemic severity on wheat in Illinois during 1943. In the northeastern part between 0.5 and 2.9% (average 1.9%) of the wheat spikelets were infected with G. zeae. In southern

and eastern Illinois from 0.2 to 1.9% (average 0.8%) of the spikelets were infected severely. Scab was especially severe in the large central part of the State, and losses in yield in this area ranged from 3 to 19% (average 11%). For a more detailed report see PDR 27(14):271, 1943.

Puccinia graminis var. tritici (stem rust). Wheat throughout most of Illinois was infected very slightly. In most fields from 60 to 100% of the culms were affected with a trace to slight stem rust at harvest. However, in one field in Whiteside County and one field in Fulton County 9.7 and 8.0% of the stem area of the upper internodes were affected by rust, respectively. The infection in the State as a whole was slight and the loss was probably 1%.

Puccinia rubigo-vera var. tritici (leaf rust) occurred in all of the fields examined, and from a trace to 26% (average 9.3%) of the leaf area of the plants was destroyed by the rust pustules. The reduction in yield possibly was directly proportional to the leaf area destroyed. See also PDR 27(17):346, 1943.

Tilletia foetida (T. levis) (bunt) occurred in only 2 of the 41 fields of wheat that were examined in Illinois during 1943. In these 2 fields 0.9 and 2% of the heads were smutted.

Ustilago tritici (loose smut). Infection was general and slight through most of Illinois, except in a small area in the east-central part, in which the level of infection was much higher than in the remainder of the State. The percentage of heads smutted and the loss in yield ranged from none to 27% and averaged 2.6%. For detailed information regarding the amount of loose smut in different areas of Illinois see PDR 27(17): 343, 1943. -- G. H. Boewe.

ZEA MAYS, CORN

Aspergillus sp. (ear rot). An occasional ear infected with Aspergillus sp. occurred in about 8% of the fields examined. -- G. H. Boewe and R. C. Baines.

Bacterium stewartii (bacterial wilt, bacterial leaf blight). Generally the early-planted sweet corn was affected slightly by wilt. The amount of inoculum was low in the spring, because of low winter temperature, but increased during the summer and caused severe leaf blight of field corn in the central and southern Illinois areas. Losses in yield from leaf blight varied from a trace to possibly 2%. -- B. Koehler, R. C. Baines, and G. H. Boewe.

Cephalosporium acremonium and other causes (black bundle). Corn affected with the black-bundle disease or exhibiting a somewhat similar diseased condition occurred in 43% of the fields. This disease was especially prevalent in southern Illinois and corn in a few fields was severely damaged. The average loss in yield for the State was about 5%. -- G. H. Boewe, R. C. Baines, and B. Koehler.

Diplodia zeae (stalk rot and ear rot). Diplodia stalk rot occurred in all fields examined and ranged from 1 to 71% of the stalks infected severely. Infected stalks in most fields had produced ears with well-matured grain. However, grain produced on infected plants appeared not to be quite so well filled as that produced by apparently healthy plants. In some fields losses of 10% in yield occurred, and the average estimated

loss was 4%.

Diplodia ear rot occurred in 46% of the fields examined and up to 5% of the ears were infected. The average loss in yield for the State was 1.5%. The percentage of ears infected with D. zeae was less than occurs in most years and it appeared that the low rainfall during September and October was unfavorable for the spread and development of this rot. -- G. H. Boewe, R. C. Baines, and B. Koehler.

Fusarium spp. (fusarium ear rot) occurred in all fields examined and on 12% of the ears. This rot usually followed ear-worm injury and generally only the tips of the ears were affected. The estimated average loss in yield was 1%. -- G. H. Boewe, R. C. Baines, and B. Koehler.

Gibberella zeae (Gibberella ear rot) occurred in 38% of the fields and on 0.5% of the ears. The loss due to the ear rot and to stalk rot was estimated to be 1%. -- G. H. Boewe, R. C. Baines, and B. Koehler.

Helminthosporium turcicum (leaf blight). From a trace to slight infection occurred on corn in many fields. One field in Christian County was severely affected and the yield reduced about 10%. The loss in yield for the State was a trace. -- B. Koehler, R. C. Baines, and G. H. Boewe.

Nigrospora sphaerica (cob rot) occurred in 19 % of the fields and on 0.6% of the ears. The estimated average loss in yield was 0.2%. -- G. H. Boewe, R. C. Baines, and B. Koehler.

Penicillium sp. (ear rot) occurred in 87% of the fields, on 6% of the ears. This rot usually followed ear-worm injury and generally occurred at the tips of the ears. The estimated average loss in yield was 0.2%.-- G. H. Boewe, R. C. Baines, and B. Koehler.

Puccinia sorghi (rust). Occasional scattered fields in northern Illinois were infected slightly to moderately. No apparent loss in yield resulted. -- R. C. Baines and G. H. Boewe.

Pythium arrhenomanes and other fungi (root rot). Root rot was unusually prevalent on early-planted sweet corn and field corn and possibly was favored by the high soil moisture and low temperature during this period. The root rot in many cases did not kill the plants, but caused them to be barren. Many market-garden plantings were replanted because of poor stands and weakened plants. The estimated reduction in yield of field corn was 5%. -- B. Koehler.

Rhizopus nigricans (ear rot). An occasional slightly infected ear occurred in 11% of the fields examined. There was no apparent loss. -- G. H. Boewe and R. C. Baines.

Sclerotium bataticola (charcoal rot). In occasional corn fields in southern Illinois from a trace to 26% of the plants were affected severely with charcoal rot. The average loss in yield in Illinois was a trace. -- G. H. Boewe.

Ustilago maydis (smut) was much less prevalent than normal. From none to 15% (average 2.5%) of the stalks were infected, usually slightly. In 50% of the fields between a trace and 9% of the ears were smutted. The estimated average loss in yield from smut was 1%. -- G. H. Boewe, R. C. Baines, and B. Koehler.

DISEASES OF FRUIT CROPS

AMYGDALUS PERSICA, PEACH. A trace of Cladosporium carpophilum (scab) occurred on peaches in southern Illinois during 1943. -- D. Powell, G.H. Boewe, H. W. Anderson.

Monilinia fructicola (Sclerotinia fructicola) (brown rot). Blossom blight was severe in one planting of Red Bird peach trees in southern Illinois and possibly also occurred in other orchards. In most orchards in southern Illinois 1% of the fruit was affected by the fruit rot. -- D. Powell, G. H. Boewe, and R. C. Baines.

Taphrina deformans (leaf curl) occurred in trace amounts. -- G. H. Boewe and D. Powell.

Xanthomonas pruni (bacterial spot). Moderate to severe infection of peach leaves occurred in most orchards, resulting in 30 to 40% defoliation in many cases. Approximately 10% of the fruit was infected slightly. -- D. Powell, G. H. Boewe, H. W. Anderson, and R. C. Baines.

FRAGARIA, STRAWBERRY. Strawberries generally were infected slightly to moderately with Mycosphaerella fragariae (leaf spot), which did not appear to cause any appreciable reduction in yield. Phytophthora fragariae (red stele) was very prevalent during the spring of 1943, especially on strawberries planted on heavy poorly drained soil. The high rainfall during May apparently was favorable for its development. The highly resistant varieties Pathfinder and Aberdeen were infected moderately to severely when planted on poorly drained soil infested with the organism. -- A. S. Colby.

MALUS SYLVESTRIS, APPLE. A trace of Erwinia amylevora (fire blight) occurred on apples in Illinois during 1943. -- H. W. Anderson and D. Powell.

Glomerella cingulata (bitter rot). Golden Delicious, Grimes Golden, and Jonathan apples in southern Illinois were infected severely. The percentage of fruits infected in different orchards ranged from a trace to 100. The variations in the severity of bitter rot in different orchards apparently were caused by differences in the quantity of initial inoculum present in the orchards and in the thoroughness and timeliness of fungicidal applications to control the disease. The estimated average loss of fruit caused by bitter rot in Illinois was 1%. -- H. W. Anderson, D. Powell, G. H. Boewe, and R. C. Baines.

Gloeodes pomigena (sooty blotch) affected a trace of the fruit in most orchards. -- R. C. Baines, D. Powell, and H. W. Anderson.

Gymnosporangium clavipes (G. germinale) (quince rust). An occasional (trace) Delicious, Rome Beauty, or Winesap apple was infected severely. -- H. W. Anderson, D. Powell, and R. C. Baines.

Gymnosporangium juniperi-virginianae (apple rust) was very severe in local areas in southern Illinois in which cedar trees are numerous and rust has been noted in the past. In one orchard that received sprays of wettable sulfur from 90 to 100% of the foliage and 14% of the fruit of Jonathan trees were infected severely. The foliage and fruit of Rome Beauty trees usually were infected moderately. The average estimated loss for the State from apple rust was 1%. -- H. W. Anderson, D. Powell, G. H. Boewe, and R. C. Baines.

Phyllosticta solitaria (blotch) was severe on Duchess and Yellow Transparent apples, which are planted extensively in southern Illinois. Blotch was also severe on the few Northwestern Greening and Winter Banana trees that usually occur in the small orchards scattered over Illinois. Between a trace and 100% of the fruit was infected severely. In a few presumably well-sprayed orchards 70% of the fruit was infected. The average estimated loss caused by blotch on these 4 very susceptible varieties was 20%. -- D. Powell and H. W. Anderson.

Physalospora obtusa (black rot, frog-eye). Frog-eye leaf spot was of general occurrence on apples in Illinois. Infection ranged from a trace to slight and apparently caused a slight reduction in yield. Black rot was more prevalent in southern Illinois than in the northern part. Approximately 10% of the Gano and 2% of the Jonathan fruit in southern Illinois were infected. The estimated average loss from black rot in the State was 3%. -- D. Powell, G. H. Boewe, H. W. Anderson, and R. C. Baines.

Venturia inaequalis (scab) was more prevalent and severe during 1943 than normally. In poorly-sprayed orchards 100% of the leaves and fruit were infected severely, and in well-sprayed orchards from a trace to 18% of the fruit was infected. It was estimated that 15 to 20% of the fruit was affected, and that the average monetary loss to the growers was 10% of the value of the crop. -- D. Powell, G. H. Boewe, H. W. Anderson, and R. C. Baines.

PRUNUS CERASUS, SOUR CHERRY. Unsprayed sour cherry trees were severely defoliated by Coccomyces hiemalis (leaf spot) and trees that had been sprayed to control the disease usually were infected and defoliated moderately. -- G. H. Boewe and R. C. Baines.

Occasional fruits were infected with Monilinia fructicola (Sclerotinia fructicola) (brown rot); however, no appreciable loss resulted. -- G. H. Boewe.

PYRUS COMMUNIS, PEAR. A trace of fire blight (Erwinia amylovora) occurred on pears in 1943. -- G. H. Boewe.

RUBUS sp., BLACKBERRY. Occasional plantings of blackberries in southern Illinois were infected severely with Gymnoconia peckiana (G. interstitialis) (orange rust). The Alfred variety appeared to be very susceptible and the Eldorado highly resistant. -- A. S. Colby.

RUBUS sp., RASPBERRY. Agrobacterium tumefaciens (crown gall) occurred in most plantings of raspberries in Illinois. Usually the plantings were infected slightly to moderately. Black raspberries usually were more severely infected than red raspberries. -- A. S. Colby.

Elsinoë veneta (anthracnose). Young raspberry canes usually were infected moderately to severely. -- D. Powell, G. H. Boewe, and R. C. Baines.

Raspberries generally were infected severely with Sphaerulina rubi (leaf spot), which caused severe defoliation by early fall. The loss in yield caused by leaf spot was not known; however, it appears that early defoliation weakens the plants and makes them more susceptible to injury from low temperature. -- A. S. Colby and R. C. Baines.

Virus diseases, chiefly mosaic. Occasional plants infected with mosaic occurred in a few plantings. -- A. S. Colby.

VITIS spp., GRAPE. A severe outbreak of Cryptosporella viticola (dead arm) occurred in the Illinois Experiment Station vineyard at Urbana and

in occasional vineyards over the State. The disease apparently had been spreading in the Experiment Station vineyard for about 3 years. The spring of 1943 was very favorable for the spread of the disease and lesions occurred on the current year's shoots of the 56 varieties in the vineyards. Differences in varietal susceptibility occurred. The dead arm or dieback phase of this disease was not so abundant or evident as the lesions on the new growth. See also PDR 17(12/13): 245-246, 1943. -- H. A. Anderson and A. S. Colby.

Grapes generally were infected moderately with Guignardia bidwellii (black rot) in Illinois. -- H. W. Anderson, D. Powell, G. H. Boewe, R. C. Baines, and A. S. Colby.

Very little Plasmopara viticola (downy mildew) developed on grapes in Illinois during 1943. -- D. Powell

PLANT DISEASES IN MICHIGAN DURING 1943

M. R. Harris

The weather in Michigan during the first part of the 1943 season was very unfavorable to agriculture. Rainfall was heavy and continuous for much of the fore part of the summer. As a result crops were a month late in starting and in many instances were not planted at all. The acreage of some crops such as sugar beets was very drastically reduced. As the summer advanced the weather improved and these crops that were planted began to make a satisfactory growth. However frost in many parts of the State was a week to 10 days earlier than usual and made the season for crops which freeze easily rather short. After a cold beginning the fall season was very favorable for the maturity and harvesting of crops and such things as soybeans and corn dried out well. This resulted in better yields than had been anticipated for most late crops.

VEGETABLES

ALLIUM CEPA, ONION. Onions were not damaged by downy mildew (Peronospora destructor) because the weather was too variable to permit development of the disease. Pink root (Phoma terrestris) did considerable damage but came so late in the season that it did not reduce the crop. There was considerable scald due to hot sun cooking the bulbs. Smut was found but treatment of the seed at planting kept the fungus (Urocystis cepulae) from doing much damage.

ARIUM GRAVEOLENS, CELERY. Celery was infected with early blight (Cercospora apii) and over the State generally there was a 4% loss. Yellows (Fusarium oxysporum f. apii) (F. apii and F. apii pallidum) was not a factor in celery production this year owing to low soil temperatures. Late blight (Septoria apii-graveolentis) caused a 6% loss over the State generally and was favored by a wet cool season.

BRASSICA OLERACEA var. CAPITATA, CABBAGE. Cabbage yellows (Fusarium oxysporum f. conglutinans) was responsible for a 3% loss over the State

generally but the loss was greatly reduced by the use of resistant varieties. In some fields where susceptible varieties were planted the loss was total.

CUCUMIS MELO, CANTALOUP. Cantaloups were severely infected with anthracnose (Colletotrichum lagenarium) in some fields and over the State, generally loss was 10%. In some fields the disease was partially controlled by spraying. Macrosporium leaf spot (Alternaria cucumerina) also caused a 10% loss. Traces of mosaic (virus) were found but no appreciable damage was caused.

DAUCUS CAROTA, CARROT. Carrots were as a rule a healthy crop but in the Detroit market garden area there was some defoliation caused by leaf blight (Alternaria carotae) (Macrosporium carotae).

LACTUCA SATIVA, LETTUCE. Lettuce over the state generally was severely affected with the aster yellows virus. There was a great prevalence of the insect vector. Many fields were a complete loss and it is estimated that for the State generally 75% of the crop was lost.

LYCOPERSICON ESCULENTUM, TOMATO. Tomatoes were adversely affected by poor weather conditions earlier in the season. Early blight (Alternaria solani) was present on plants imported from the southern states. Canker (Corynebacterium michiganense) (Aplanobacter michiganense) was also found on plants coming in from nurseries in the southern States. Anthracnose (Colletotrichum phomoides) was severe in some fields causing damage to the fruit. It reduced the crop over the State generally by 5%. Fusarium wilt (Fusarium oxysporum f. lycopersici) caused a 1% loss. There were traces here and there of blossom-end rot (physiogenic) and mosaic and spotted wilt (viruses). In the Victory gardens around Detroit blight (Septoria lycopersici) was severe in spots and caused a 1% reduction of the crop.

PHASEOLUS VULGARIS, BEAN. Beans in some of the market gardens around Detroit were severely infected with anthracnose (Colletotrichum lindemuthianum). About 2% of the total crop was lost. Bacterial blight (Xanthomonas (Phytomonas) phaseoli and Corynebacterium (P.) flaccumfaciens) was severe on Black Valentine, Bountiful, and Plentiful varieties in market gardens and reduced the crop by 2%.

SOLANUM TUBEROSUM, POTATO. The potato crop of Michigan was reduced by scab (Actinomyces scabies) by approximately 10% last season. Early blight (Alternaria solani) was not severe and caused a 2% reduction of the crop. A trace of ring rot (Corynebacterium (Bacterium) sepedonicum) was found in a few fields. Black leg (Erwinia phytophthora) (E. atroseptica) was favored by weather conditions and caused a 1% loss to the crop. Traces of fusarium wilt (Fusarium oxysporum) also favored by weather conditions, were noted. It is estimated that damage caused by leafhoppers was sufficient to cause a 25% reduction of the crop. In some fields this insect caused a total loss. Late blight (Phytophthora infestans) was present in many fields but owing to variable weather conditions during the latter part of the season it never became serious. The estimated loss is only 0.35% for the entire State although individual fields showed as high as 80% loss. Scurf (Rhizoctonia solani) caused a 1% loss to the crop. A trace of purple top wilt caused by aster yellows virus was seen in one field. Traces of the virus diseases, leaf roll, mosaic,

spindle tuber, and yellow dwarf, were observed but these did no apprecia-ble damage.

FIELD CROPS

AVENA SATIVA, OATS. A severe leaf rust (Puccinia coronata) infection of oats reduced the crop by 20% during the past season. A Michigan hybrid strain of high yielding qualities was severely affected by the rust for the first time this season. Loose smut (Ustilago avenae) and covered smut (Ustilago kolleri) (U. levis) each reduced the oat crop yield by 0.2%.

BETA VULGARIS, SUGAR BEET. Sugar beet leaf spot (Cercospora beticola) caused a loss of 0.2%. The acreage of sugar beets in the State was drastically reduced by poor weather conditions at the time of planting. As a result various root-rotting fungi damaged the young plants and it is estimated that the total damage from these fungi was 10%.

HORDEUM VULGARE, BARLEY. Barley head blight (Gibberella zeae) (G. saubinetii) reduced the yield by 10%. Blotch (Helminthosporium sativum) caused 0.5% loss. There was a trace of stem rust (Puccinia graminis) in some fields. Loose smut (Ustilago nuda) and covered smut (Ustilago jensenii) (U. hordei) each caused a 0.1% loss.

MEDICAGO SATIVA, ALFALFA. Alfalfa fields were generally infected with wilt and root rot (Corynebacterium insidiosum) (Phytomonas insidiosa) and there is some loss each year in at least half of the fields in the State. It is estimated that the yearly loss is 5%. Damage amounting to a trace is caused by leaf spot (Pseudopeziza medicaginis).

SOJA MAX, SOYBEAN. Soybeans in Michigan were planted late and consequently matured late. Frost caught many late fields. A trace of frog-eye spot (Cercospora sojina) (C. daizu) was found in many fields. In a few fields a trace of pod and stem blight (Diaporthe sojae) was seen but no damage was noted. Likewise anthracnose (Glomerella glycines) was found on a plant here and there in a few fields. Downy mildew (Peronospora manshurica) at one time during the latter part of the season appeared to be about to cause some damage but never developed beyond a trace in most fields. In many fields an occasional plant showing virus symptoms could be seen but no seriously infected field was seen. Bacterial pustule (Xanthomonas phaseoli var. sojense) was by far the most common disease seen and no field appeared to be completely free from it. It is estimated that it caused a leaf fall reducing the crop by 2%.

TRITICUM AESTIVUM, WHEAT. Wheat head blight (Gibberella zeae) (G. saubinetii) caused a 10% reduction in the yield of that crop. Stem rust (Puccinia graminis) reduced the yield by 3% and leaf rust (Puccinia rubigo-vera var. tritici) (P. triticina) by 2%.

MISCELLANEOUS HOSTS

FRUIT CROPS. Owing to restrictions on travel by the experiment station staff, no very extensive observations were made on fruit diseases. It was noted that brown rot (Monilinia (Sclerotinia) fructicola) and leaf

spot (Coccomyces hiemalis) each reduced the cherry crop by 10%. Brown rot was also severe on peaches causing a 10% reduction of the crop while peach canker (Valsa leucostoma) killed 5% of the peach trees. Apple scab (Venturia inaequalis) was severe in many of the State's orchards and caused a loss of 10% over the State generally.

MENTHA spp., MINTS. The growing of mint crops is an important industry in Michigan. Diseases of mints may be serious. Anthracnose on peppermint (Sphaceloma menthae) was not severe but traces were present. Winter injury killed about 15% of the plants last winter when the snow melted and a severe freeze followed. Wilt (Verticillium sp.) killed about 5% of the crop. Rust (Puccinia menthae) is severe some seasons and this year affected late cuttings. In one field it reduced the crop by 20% but generally was present only as a trace.

PICEA sp., SPRUCE. Among the forest trees rust (Chrysomyxa cassandrae) on spruce was very severe in many locations in the north central part of the State. On some trees as much as 30% of the needles were infected.

PLANT DISEASES OBSERVED IN WISCONSIN IN 1943

Edwin E. Honey and R. E. Vaughan

VEGETABLE DISEASES

ALLIUM CEPA, ONION. Neck rot (Botrytis sp.) was less important than usual, owing probably to good weather at harvest time. The usual scattered traces of anthracnose (Colletotrichum circinans) were observed. Smut (Urocystis cepulae) as usual, was scattered in distribution, being found only on soil long used for growing onions.

APIUM GRAVEOLENS, CELERY. The usual slight amounts of early blight (Cercospora apii) and moderate amounts of late blight (Septoria apii) occurred. Stem canker due to boron deficiency is decreasing since growers have been using boron for its control.

ASPARAGUS OFFICINALIS, ASPARAGUS. Rust (Puccinia asparagi) was of slight importance, as usual. The resistance of the Washington varieties is not complete.

BETA VULGARIS, GARDEN BEET. Leaf spot (Cercospora beticola), although less prevalent than usual, was observed in various gardens, and in particular in Dane County and central Wisconsin where it was present but not destructive during the August dry period. Scab (Actinomyces scabies) and damping-off (Rhizoctonia and/or Pythium) were of the usual slight importance. More internal black spot due to boron deficiency was noted than occurred during the preceding year, although boron for soil treatment is generally available to canners in affected regions.

BRASSICA CAMPESTRIS, RUTABAGA. A greatly expanded acreage planted to rutabagas was accompanied by an increase in prevalence of black rot (Xanthomonas campestris). Internal spot due to boron deficiency is being controlled by the use of boron in fertilizer and is decreasing in importance.

BRASSICA OLERACEA var. BOTRYTIS, BROCCOLI and CAULIFLOWER. Black rot (Xanthomonas campestris) was noted to a slight extent as usual on both crops. Yellows (Fusarium oxysporum f. conglutinans) was of the usual slight local importance on cauliflower.

BRASSICA OLERACEA var. CAPITATA, CABBAGE. Leaf spot (Alternaria circinans) (A. brassicae), yellows (Fusarium oxysporum f. conglutinans), and black leg (Phoma lingam) were scattered in occurrence and of slight importance to the crop as a whole, as usual. Dry hot weather favored the development of yellows in the Racine area of southeastern Wisconsin. Much more club root (Plasmodiophora brassicae) than usual was observed. Black rot (Xanthomonas campestris) was more prevalent in some areas than during the year before. The disease was conspicuous in the Outagamie County area in northern Wisconsin, while less was noted in the vicinity of Racine. Most of this trouble is traceable to lack of rotation or to use of plants from infected seedbeds.

A mosaic (virus) that is being investigated by Dr. J. C. Walker and his associates, occurred in scattered localities.

CAPSICUM FRUTESCENS, PEPPER. Bacterial leaf spot (Xanthomonas vesicatoria) was scattered in distribution.

CUCUMIS MELO, CANTALOUP. Scattered infections of leaf blight (Alternaria cucumerina) and downy mildew (Pseudoperonospora cubensis) were noted, but dry weather prevented significant development. The reduction in acreage planted to cantaloups gave a better chance for crop rotation with a consequent decrease in amount of anthracnose (Colletotrichum lagenarium) from the preceding year. Mosaic (virus) occurred in scattered infections and was of slight importance as usual.

CUCUMIS SATIVUS, CUCUMBER. Leaf blight (Alternaria cucumerina) scab (Cladosporium cucumerinum), anthracnose (Colletotrichum lagenarium), bacterial wilt (Erwinia tracheiphila), and angular leaf spot (Pseudomonas lachrymans) were of average importance or somewhat less. Powdery mildew (Erysiphe cichoracearum) was observed in Portage County. Mosaic (virus) occurred locally in moderate amounts. In Portage County in central Wisconsin, frost injury that occurred in the early part of June when the plants had about 5 leaves, was evident in August as brown necrotic areas on the leaf edges.

DAUCUS CAROTA, CARROT. Leaf blight (Cercospora carotae) was generally distributed but was held in check by hot dry weather and only the lower leaves were affected. Yellows (aster yellows virus) was general in occurrence and of moderate importance.

LYCOPERSICON ESCULENTUM, TOMATO. Early blight (Alternaria solani) and leaf spot (Septoria lycopersici) were general in occurrence, but dry weather during the summer and also, in the case of Septoria, the increased use of mulching, resulted in less loss than average. Dusting for control is not recommended for Wisconsin conditions and little is done. Anthracnose (Colletotrichum phomoides) appeared in scattered locations late in the season. Wilt (Fusarium oxysporum f. lycopersici) was noted in a field near a greenhouse. Specimens of fruit affected by buckeye rot (Phytophthora parasitica) were received from Polk and Taylor Counties in northern Wisconsin September 1. A considerable amount of blossom-end rot (physiogenic) occurred in the Racine area which was affected by drought; elsewhere, a reasonable amount of rainfall resulted in less blossom-end rot

than usual.

Leaf mold (Cladosporium fulvum) was more prevalent on greenhouse tomatoes than usual because of delay in heating the houses. Rootknot (Heterodera marioni) was observed only in greenhouses.

PASTINACA SATIVA, PARSNIP. Leaf spot (Cylindrosporium pastinacae) (Phyllachora pastinacae), was observed in farm and victory gardens in Dane and Columbia Counties. Yellows caused by the aster yellows virus was reported from Door County.

PHASEOLUS VULGARIS, BEAN. No disease was recorded as very important. The bacterial blights (Pseudomonas medicaginis var. phaseolicola and Xanthomonas phaseoli), anthracnose (Colletotrichum lindemuthianum), dry root rot (Fusarium solani f. phaseoli) (F. martii phaseoli), stem canker (Rhizoctonia sp.), rust (Uromyces phaseoli var. typica), and mosaic (virus) were observed to occur in the usual prevalence or less.

PISUM SATIVUM, PEA. Root rot (Aphanomyces euteiches) is a very important disease of peas in Wisconsin; it occurs generally where peas are grown and affects all varieties. In 1943 an increase in prevalence from the normal was due to the reuse of infested soil and to favorable wet weather; however, there was less than in 1942. Wet weather also favored general occurrence and increased amounts of bacterial blight (Pseudomonas pisi), and anthracnose (Colletotrichum pisi), and also the ascochyta blights (Mycosphaerella pinodes, Ascochyta pisi, and A. pinodella), of which M. pinodes was most important. No cases of fusarium wilt (Fusarium oxysporum f. pisi race 1) (F. orthoceras var. pisi) were seen; since resistant varieties are used where the soil is known to be infested this disease has become unimportant. Fusarium root rot (F. solani f. pisi) also was of slight importance and less prevalent than usual. Near wilt (F. oxysporum f. pisi race 2), on the other hand, was more abundant than during the preceding year. Powdery mildew (Erysiphe polygoni), downy mildew (Peronospora pisi), and blotch (Septoria pisi) were of slight importance as usual. The virus diseases mosaic and streak caused moderate damage.

SOLANUM MELONGENA, EGGPLANT. Occasional plantings of this crop were noted. Dry weather held the blight due to Phomopsis vexans in check and it caused very little fruit rot, occurring mostly as a leaf spot.

SOLANUM TUBEROSUM, POTATO. Scab (Actinomyces scabies) is a major disease of potatoes in Wisconsin, and in 1943 was even more important than usual. Dry weather while the crop was maturing favored its development, and infection in some fields ranged up to as much as 85%; for the State loss is estimated at 4%. The varieties Russet Rural and Russet Burbank were resistant.

A marked increase in amount of bacterial ring rot (Corynebacterium sepedonicum) over the preceding year was evident. It is not generally distributed in the State, occurrence being limited to scattered locations. Vine symptoms were obscured by the prevalence of late blight and hopperburn. Up to 50% field infection was observed, while the loss for the State was a trace.

Late blight (Phytophthora infestans), while less damaging than in 1942, was more prevalent than usual. Infection was general except in the drought area of southeastern Wisconsin. Elsewhere in the State wet weather until the latter part of June favored vine infection. Drought and high

temperatures after June 20 checked the development of the disease, although in northern Wisconsin local rains resulted in some damage from tuber rot. Much more use was made of copper sprays and dusts than usual, but the amount of spraying was limited by availability of machines. Reduction in yield due to late blight amounted to 5%; tuber rot caused 4% loss.

Other diseases, of minor importance, that were more prevalent than usual were wilt caused by Fusarium avenaceum and silver scurf caused by Spondylocladium atrovirens. Loss from wilt was estimated at a trace.

Average amounts of early blight (Alternaria solani), and black leg (Erwinia phytophthora) were noted, while rhizoctonia (Pellicularia filamentosa) (Corticium vagum) was less prevalent than usual. These diseases ordinarily are unimportant.

Of the virus diseases, mild crinkle mosaic was locally distributed and caused moderate damage, as usual. Resistant varieties grown include Rural, Chippewa, Katahdin, Sebago, and Warba, while Green Mountain and Triumph are susceptible. Leaf roll, spindle tuber, and yellow dwarf are scattered in occurrence and of minor importance; in 1943 leaf roll and spindle tuber were average in prevalence, while less yellow dwarf was noted than usual. Sebago and Katahdin are susceptible to the curl type of leaf roll, and Sebago is resistant to yellow dwarf. Spindle tuber is prevalent in rundown stocks of Chippewa.

The increased application of sprays and dusts resulted in less hopperburn due to leafhoppers than usually occurs. This trouble was most prevalent in the drought-affected southeastern part of the State. Loss was estimated at 0.5%.

Spindle sprout and sprain (both undetermined) were noted in slight amounts in scattered locations.

Discoloration of tubers following cooking (physiogenic) developed to a less extent than usual.

Injury from frost occurring before harvest was spotted in distribution and caused a trace of loss. Much less sun scald developed than usual; loss was practically none.

TRAGOPOGON PORRIFOLIUS, SALSIFY. Yellows caused by the aster yellows virus was observed on salsify in Door County, where the disease was abundant and severe.

DISEASES OF CEREALS, GRASSES, AND FORAGE CROPS

AGROPYRON REPENS, QUACK GRASS. Diseases observed are ergot (Claviceps purpurea) in Dane and Waupaca Counties; and powdery mildew (Erysiphe graminis), tar spot (Phyllachora graminis), and stem rust (Puccinia graminis) which were all of general occurrence.

AGROSTIS ALBA, RED TOP. Leaf rust (Puccinia rubigo-vera) and brown stripe (Scolecotrichum graminis) occurred generally.

AVENA SATIVA, OATS. Traces of loss were recorded from bacterial blight (Pseudomonas coronafaciens), crown rust (Puccinia coronata), stem rust (Puccinia graminis), and loose and covered smuts (Ustilago avenae and U. kolleri). The generally grown variety Vicland is resistant to both rusts and both smuts.

BROMUS INERMIS, SMOOTH BROME GRASS. Ergot (Claviceps purpurea) was observed in Dane and Waupaca Counties. Bacterial spot (Pseudomonas coronafaciens var. atropurpurea), leaf scald (Rhynchosporium secalis) and leaf spots caused by Helminthosporium bromi, Selenophoma bromigena, and Septoria bromi, were general in distribution.

CENCHRUS PAUCIFLORUS, FIELD SAND BUR. Head smut (Sorosporium syntherismae) was collected in Columbia County in August and September.

HORDEUM VULGARE, BARLEY. Ergot (Claviceps purpurea) was abundant in regions where quack grass was present, and caused a trace of loss. Leaf spot, stem blight, and head blight due to Helminthosporium sativum and H. teres were severe, and the resultant loss is estimated at 5%. Loose smut (Ustilago spp.) caused a loss of 0.5%. Covered smut (U. jensenii), powdery mildew (Erysiphe graminis), and scab (Gibberella zeae) caused only traces of loss. No loss was recorded from stripe (Helminthosporium gramineum), leaf rust (Puccinia anomala), stem rust (Puccinia graminis), or scorch (Rhynchosporium secalis).

LINUM USITATISSIMUM, FLAX. Pasmo (Mycosphaerella linorum) (Sphaerella linorum) caused a trace of loss; none was recorded from other diseases.

MEDICAGO SATIVA, ALFALFA. During a survey in October (PDR 27(21): 566, Oct. 22, 1943) the known range of bacterial wilt (Corynebacterium insidiosum) in the State was extended northward. Indications were that this disease and winter injury were the main conditions responsible for dying out of alfalfa stands after 2 or 3 years.

Of other diseases observed leaf spot (Pseudopeziza medicaginis) was most general, although yellow leaf blotch (Pyrenopeziza medicaginis) was more severe in certain fields. Downy mildew (Peronospora trifoliorum), leaf spot (Pseudoplea briosiana), rust (Uromyces striatus) and yellows (leafhopper injury) were also present.

MELILOTUS spp., SWEETCLOVER. Stem blight and leaf spot (Cercospora meliloti), blight (Mycosphaerella lethalis), downy mildew (Peronospora trifoliorum), and root rot (Phytophthora cactorum) were less prevalent than in 1942.

PHLEUM PRATENSE, TIMOTHY. Brown stripe (Scolecotrichum graminis), stem rust (Puccinia graminis var. phlei-pratensis), and stripe smut (Ustilago striaeformis) were recorded.

POA PRATENSIS, KENTUCKY BLUEGRASS. Claviceps purpurea, Erysiphe graminis, Helminthosporium vagans and Septoria sp. causing leaf spots, rusts due to Puccinia poae-sudeticae and P. rubigo-vera, and stripe smut caused by Ustilago striaeformis occurred in the usual amounts.

SECALE CEREALE, RYE. Traces of loss were recorded from ergot (Claviceps purpurea), anthracnose (Colletotrichum graminicolum), scab (Gibberella zeae), and stalk smut (Urocystis occulta). No loss was caused by either stem rust (Puccinia graminis) or leaf rust (P. rubigo-vera var. secalis).

SETARIA spp., FOXTAIL GRASS. Leaf spot (Piricularia grisea) was noted on both S. lutescens, yellow foxtail grass, and S. viridis, green foxtail grass. Head smut (Ustilago neglecta) occurred on S. lutescens.

SOJA MAX, SOYBEAN. More downy mildew (Peronospora manshurica) was evident than usual. Bacterial blight (Pseudomonas glycinea) caused damage amounting to a trace on the crop cut for hay. Bacterial pustule (Xanthomonas phaseoli var. sojense) occurred in the usual slight importance.

Mosaic (virus) was less prevalent than usual and caused a trace of loss. At least 2 types, a mottling type and a dwarfing type, were evident. Mendota was very resistant, vegetable types generally were susceptible, and Etum was very susceptible.

SORGHUM VULGARE, SORGHUM. Covered smut (Sphacelotheca sorghi) caused a trace of damage.

SORGHUM VULGARE, var. SUDANENSE, SUDAN GRASS. Diseases recorded, all of general occurrence and in the normal amounts, were anthracnose (Colletotrichum graminicolum), leaf blight (Helminthosporium turcicum), bacterial spot (Pseudomonas andropogoni), rust (Puccinia purpurea), and kernel smut (Sphacelotheca sorghi).

TRIFOLIUM spp., CLOVER. Diseases occurred in about average amounts. On red clover, T. pratense, powdery mildew (Erysiphe polygoni), northern anthracnose (Kabatiella caulivora), and black stem (Phoma trifolii) are most important, the last-named being especially severe in late summer and early fall. Minor diseases include leaf spot (Cercospora zebrina), sooty blotch (Cymadothea trifolii), bacterial leaf spot (Pseudomonas syringae) (P. trifoliorum), leaf spot (Stemphylium sarcineaforme), and rust (Uromyces trifolii var. fallens). Stemphylium leaf spot and rust are most prevalent late in the season.

Sooty blotch occurs on white clover, T. repens, as well as red clover.

TRITICUM AESTIVUM, WHEAT. Losses from leaf rust (Puccinia rubigo-vera var. triticina) and stem rust (P. graminis var. tritici) were estimated at 5% and 0.5%, respectively. Foot rot (Helminthosporium sativum), scab (Gibberella zeae), bunt (Tilletia spp.), and loose smut (Ustilago tritici) caused traces of loss.

ZEA MAYS, CORN. Information on diseases of corn was contributed by P. E. Hoppe.

Bacterial wilt (Bacterium stewartii) was of slight importance, as usual.

Ear rots and stalk rots generally were less prevalent than in 1942 or the average year. This was true of ear and stalk rot caused by Diplodia zeae and by Fusarium sp., ear rot caused by Gibberella zeae and by Nigrospora sphaerica, and kernel rot due to Penicillium sp. The low incidence of Fusarium ear rot was associated with minimum damage from ear worm. Dry conditions at the silking period resulted in a minimum amount of ear infection by Gibberella zeae in the southern part of the State.

The seedling blight due to Gibberella zeae was of the usual slight importance.

Incidence of rust (Puccinia sorghi) was average, the disease being generally distributed but causing little damage.

Smut (Ustilago maydis) was less prevalent than usual. Certain sweet corn varieties are more susceptible than others.

Losses from smut were estimated at a trace to 1%; other loss estimates were a trace each from Nigrospora ear rot and Gibberella ear rot.

DISEASES OF FRUIT CROPS

FRAGARIA spp., STRAWBERRY. Leaf scorch (Diplocarpon earliana), leaf spot (Mycosphaerella fragariae), and blackroot associated with low temperatures occurred generally.

MALUS SYLVESTRIS, APPLE. Crowngall (Agrobacterium tumefaciens) occurred to the usual extent in nurseries.

Fireblight (Erwinia amylovora) infection was favored by the succulent wood growth induced by favorable rains and more occurred than during 1942 or than usual. Wet weather in May and early June also favored the development of apple rust (Gymnosporangium juniperi-virginianae) and scab (Venturia inaequalis) and both were more severe than usual, although not more prevalent than during the preceding year. Scab was the major disease in all orchards. Ascospores were mature on April 28, which is later than usual. The main period of ascospore discharge was from May 24 to June 4, and infection was first noted June 8.

Black rot (Physalospora obtusa) occurred in the usual amounts, mostly in old neglected trees in southern sections.

Dry weather at harvest time resulted in reduced amounts of the minor diseases fly speck (Leptothyrium pomi), blotch (Phyllosticta solitaria), and core mold (Alternaria sp. and Fusarium sp.).

Bitter pit (physiogenic) also was less troublesome than usual.

Frost damage from low temperatures at blossoming time was much less destructive than during 1942; the loss being estimated at a trace. About the average amount of winter-killing occurred.

PRUNUS CERASUS, SOUR CHERRY. Leaf spot (Coccomyces hiemalis) is one of the most important factors affecting production of this important fruit crop in Wisconsin. During 1943 as in the preceding year, weather favored its development and it was more prevalent than usual. The peak of ascospore discharge was reached early, during blossom.

Favorable weather also resulted in above-normal infection by both brown rot fungi, Monilinia laxa and M. fructicola. The presence of M. laxa in Wisconsin, where it was first observed in 1941, has been reported by G. W. Keitt et al. (Phytopath. 33:1212, Dec. 1943). Previously this fungus was not known to occur in this country outside of the Pacific Coast area. Observations so far have been limited to Door County. The spur blight caused by M. laxa was of great importance in some orchards where as many as 75% of the spurs were killed. Early Richmond was more susceptible than Montmorency. M. fructicola occurred locally, primarily as a blossom blight. In some orchards 80% of the blossoms were affected.

Cherry yellows (virus), another disease of major importance in Wisconsin, increased in prevalence over both the preceding year and the average year.

Necrotic ringspot (virus) is reported from Wisconsin for the first time, although it has been recognized as a distinct trouble since about 1934 but not well understood.

An increased amount of winter killing was related to poor leaf spot control in 1942. Some frost damage was noted.

PRUNUS spp., PLUM. Scab (Cladosporium carpophilum) was less prevalent than in both the preceding and the average year. Black knot (Dibotryon morbosum) occurred in normal amounts. Although moisture conditions

early in the season favored brown rot (Monilinia fructicola), later dry weather resulted in no more than average and less than in 1942. Plum pockets (Taphrina pruni) occurred to the usual extent on susceptible americana plums. Bacterial spot on the leaves (Xanthomonas pruni) occurred in scattered locations.

PYRUS COMMUNIS, PEAR. Pears are not a commercial crop in Wisconsin. Fireblight (Erwinia amylovora) and scab (Venturia pyrina) were both more severe than usual.

RIBES GROSSULARIA, GOOSEBERRY. Rust (Cronartium ribicola) occurred as usual; it is important in connection with distribution on white pine. Rust (Puccinia grossulariae) was more prevalent than usual; it occurs locally and is most severe near marsh grass. Anthracnose (Pseudopeziza ribis) and powdery mildew (Sphaerotheca mors-uvae) occurred in the usual amounts.

RIBES SATIVUM, RED CURRANT. Rust (Cronartium ribicola) was scattered in occurrence; it is of slight importance on red currant but serious in connection with infection of white pine. It was also observed on cultivated R. odoratum and R. nigrum, but it has not been observed on R. alpinum nor on Viking currant. Anthracnose (Pseudopeziza ribis) was normal in occurrence.

RUBUS spp., BLACKBERRY. Rust (Gymnoconia peckiana) is the limiting factor in blackberry growing; there was more than usual in 1943. Anthracnose (Elsinoë veneta) also showed an increase in prevalence over normal. Crowngall (Agrobacterium tumefaciens) and mild mosaic (virus) occurred to the usual extent. On wild blackberry sooty blotch (Gloeodes pomigena) and fly speck (Leptothyrium pomi) were noted.

RUBUS spp., DEWBERRY. Anthracnose (Elsinoë veneta) was normal in occurrence.

RUBUS spp., RASPBERRY. On black raspberry, anthracnose (Elsinoë veneta) occurred in average amounts. It was favored by wet weather early in the season but dry weather prevailed from the latter part of June.

On red raspberry, crowngall (Agrobacterium tumefaciens), spur blight (Didymella applanata), anthracnose (Elsinoë veneta), orange rust (Gymnoconia peckiana) (G. interstitialis) were of normal prevalence, as was mosaic (virus).

VACCINIUM spp., CRANBERRY. False blossom (virus) is general in cranberry bogs. Leafhoppers, the insect vector, were more abundant than in 1942 but control with pyrethrum prevented the development of more than the average amount of false blossom, although there was more than in the preceding year. Storage rots due to Penicillium spp. and other fungi were average in occurrence.

VITIS spp., GRAPE. Dry weather at harvest prevented black rot (Guignardia bidwellii) from developing in more than normal amounts, and there was less than last year. Downy mildew (Plasmopara viticola) also was normal in prevalence and less important than in 1942. Wild varieties are susceptible to downy mildew.

DISEASES OF SPECIAL CROPS

BETA VULGARIS, SUGAR BEET. Tip root rot (Aphanomyces sp.) was less prevalent than usual, an occasional rotted beet being observed in a few fields.

Leaf spot (Cercospora beticola) was much less important than usual. It was severe in an occasional field, but in most it occurred in traces or not at all. Dry weather late in the season and cool nights were not conducive to its spread.

Root rot (Phoma betae) was of less importance than usual; traces were observed in scattered fields.

Crown rot due to Rhizoctonia solani and Pythium sp., although more common in occurrence than usual, caused only slight loss. In a few fields damage to the roots was appreciable; elsewhere it amounted to only a trace. Infection of petioles and leaves occurred very generally but damage was light in most fields examined.

Heart rot due to boron deficiency was less troublesome than usual although more was observed than in 1942. The condition appeared very late in the season and became most prevalent in the dry southeastern part of the State east and south of Lake Winnebago. Late rains in most areas were unfavorable to its development.

HELIANTHUS ANNUUS, CULTIVATED SUNFLOWER. Powdery mildew (Erysiphe cichoracearum) occurred to the usual slight extent. Rust (Puccinia helianthi-mollis) was generally less common than last year, except in northern sections with greater rainfall.

NICOTIANA TABACUM, TOBACCO. Information on tobacco diseases was contributed by James Johnson.

Much less blackfire (Pseudomonas angulata) than usual occurred in fields; the disease was conspicuous by its absence except in one section in the vicinity of Rio in Columbia County. It was rare in seedbeds also.

A new outbreak of wildfire (Pseudomonas tabaci) was found this year in the northern tobacco district of the State, on isolated farms in Vernon and Crawford Counties. Infection was heavy in some fields. Recurrent infection was noted in Rock County.

Black root rot (Thielaviopsis basicola) occurred to the same extent as last year, which is less than usual. The loss caused was estimated at 5% from reduction in yield and 10% in grade. The use of resistant varieties is very general.

Damage from mosaic (virus) was less than usual. The disease occurred to some extent in most fields and high percentages of infection were observed in scattered fields. Loss was estimated at 1% from reduction in yield and 2% from lowered quality. Streak (virus) was of slight importance, as usual, although it was generally distributed and more occurred than in 1942. High percentages of infection were noted on the borders of occasional fields.

Potash hunger due to potassium deficiency was less damaging than usual. This trouble is not important in relation to yield but the low potash content reduces quality of the crop.

Brown root rot (cause undetermined) was scattered in distribution. There was a slight increase this year in the use of "sod fields" with resultant brown root rot. As many as 50% affected plants were observed in some fields. The reduction in yield was estimated at 1%.

No frenching (cause undetermined) was seen in 1943.

The crop was generally late in development. The cool wet spring delayed transplanting.

DISEASES OF ORNAMENTALS AND MISCELLANEOUS PLANTS

A comprehensive report on forest tree diseases has been given in the Plant Disease Reporter (28(6):172-180. Mar. 15, 1944).

AGRIMONIA sp. Pucciniastrum agrimoniae, rust, was common in Langlade County in August.

ALTHAEA ROSEA, HOLLYHOCK. Very few specimens of Puccinia malvacearum, rust, were seen in 1943.

AMARANTHUS RETROFLEXUS, PIGWEED. Albugo bliti, white rust and Gloeosporium amaranthicola, anthracnose, were common during August in Green Lake County and elsewhere.

ANTIRRHINUM MAJUS, SNAPDRAGON. Puccinia antirrhini, rust, occurred as usual in greenhouses, and late in the season in most gardens.

ASCLEPIAS SYRIACA, MILKWEED. Yellows caused by the aster yellows virus was observed in Door County.

ASTER MACROPHYLLUS, BROAD-LEAF ASTER. Coleosporium solidaginis, rust, was generally distributed and common in September. Septoria atropurpurea, leaf spot, was common on Madeline Island in Ashland County in September.

CALLISTEPHUS CHINENSIS, CHINA ASTER. A severe infection of Coleosporium solidaginis, rust, was noted in Langlade County. Fusarium oxysporum f. callistephi (F. conglutinans var. callistephi), wilt, was scattered in distribution and less important than usual. Aster yellows (virus) was generally distributed as usual.

CELASTRUS SCANDENS, BITTERSWEET. Ramularia celastri, leaf spot, was common in Columbia County.

CHRYSANTHEMUM sp. An undetermined species of Coleosporium was sent in from Langlade County. Erysiphe cichoracearum, powdery mildew, was more evident than usual.

CONVOLVULUS sp., BINDWEED. Puccinia convolvuli, rust, was general and abundant during August.

CORYLUS CORNUTA, BEAKED HAZEL. Gloeosporium coryli, leaf spot, was scattered in occurrence. It was observed commonly in Wood and Adams Counties.

DAHLIA spp. Mosaic (virus) was scattered in occurrence and less important than usual. Commercial growers pull out infected plants as soon as symptoms are noted.

DELPHINIUM spp., LARKSPUR. Botrytis sp. causing blight was more abundant than usual owing to wet weather early in the season. Infection by Pseudomonas delphinii, black spot, was checked by drought almost as soon as it appeared.

EPILOBIUM ANGUSTIFOLIUM, FIREWEED. Pucciniastrum pustulatum, rust, was common throughout the State. It was noted especially on Madeline Island in Ashland County.

GAULTHERIA PROCUMBENS, WINTERGREEN. Gloeodes pomigena, sooty blotch, and Leptothyrium pomi, fly speck, were general in occurrence.

GLADIOLUS spp. Pseudomonas marginata, scab, and Septoria gladioli, hard rot, were normal in prevalence; scab was generally distributed while hard rot was noted in scattered locations. Xanthomonas gummisudans, bacterial spot, was more prevalent than usual in the local areas where it occurred. Less mosaic (virus) than usually occurs was noted in scattered plantings. A general increase, from the normal amount and from that

noted last year, of whitening due to thrips injury seems to be associated with the reduction in the use of bichloride of mercury for treatment. The better growers will resume the use of bichloride if it can be obtained.

HELIANTHUS sp., WILD SUNFLOWER. Puccinia helianthi, rust, was collected in Marathon and Dane Counties in August.

IMPATIENS BIFLORA, JEWELWEED. Ramularia impatientis, leaf spot, was collected in Columbia County in August.

IRIS spp. Didymellina iridis, leaf spot, occurred in local areas in average amounts, although less than in 1942. Erwinia carotovora, root rot, was scattered in distribution and less important than usual.

LILIUM spp. Botrytis sp. causing blight of regal lily (L. regale) was favored by wet weather and more developed than usual although not more than last year. Mosaic (virus) was not serious.

MENTHA sp., WILD MINT. Puccinia menthae, rust, was collected in Green Lake County in August. Septoria menthicola, leaf spot, was collected in September on Madeline Island in Ashland County.

PAEONIA sp., PEONY. Botrytis sp., blight, occurred to the same extent as in 1942 which was more than usual. Wet weather in the early part of the season favored its development. Dry hot weather later in the season reduced the prevalence of Cladosporium paeoniae, leaf spot, and Erysiphe cichoracearum, powdery mildew. Heterodera marioni, rootknot, was of the usual slight importance in scattered locations.

POLYGONUM sp., SMARTWEED. Ustilago utriculosa, head smut, was collected in Waupaca County in August.

POTENTILIA MONSPELIENSIS, CINQUEFOIL. Ramularia arvensis, leaf spot, was collected in Green Lake County in August.

ROSA spp., ROSE. Agrobacterium tumefaciens, crowngall, was local in distribution, infection being largely confined to greenhouse plants. Diplocarpon rosae, black spot, was of less than normal importance, dry weather at the critical period preventing the usual amount of infection. Phragmidium sp., rust, was scattered in distribution as usual. Wild type rose varieties are susceptible. Sphaerotheca pannosa, powdery mildew, occurred locally in the usual amounts. Rugosa varieties showed resistance; Dorothy Perkins and Paul Scarlet were susceptible.

RUBUS PARVIFLORUS, THIMBLEBERRY. Septoria rubi, leaf spot, was collected on Madeline Island, Ashland County, in September.

SYMPHORICARPOS ALBUS, SNOWBERRY. Glomerella cingulata, anthracnose, was scattered in occurrence and less abundant than usual. Severe fruit and leaf infection by Sphaceloma symphoricarpi, scab, was observed in Waupaca County in August.

* TAGETES spp., MARIGOLD. Yellows (aster virus) was observed in Door County where yellows on asters was quite severe.

TARAXACUM OFFICINALE, DANDELION. Ramularia taraxaci, leaf spot, was common in August. Sphaerotheca humuli var. fuliginea, powdery mildew, occurred generally.

TULIPA sp., TULIP. Botrytis sp., blight, was favored by wet weather in the early part of the season and more occurred than normally. The usual amount, in scattered locations, of breaking due to virus was noted.

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* SYRINGA VULGARIS, LILAC. Microsphaera alni, powdery mildew, was general in distribution and normal in prevalence.

PLANT DISEASE SURVEY IN MINNESOTA[1]

Ian W. Tervet

Of possibly greatest interest in the plant disease situation in Minnesota in 1943 was the development of large pustules of stem rust (Puccinia graminis var. avenae Race 8) on the hitherto resistant oat varieties, Vicland, Tama, etc., that derived their resistance from the Richland variety. If race 8 of P. graminis avenae increases in population in the future, there need be little expectation that the oats of Richland parentage will have any advantage in stem rust resistance over the varieties such as Gopher, hitherto grown in Minnesota. Stem rust was of little importance on wheat and barley. A moderately heavy epidemic of crown rust (Puccinia coronata) caused some reduction in yield but the intensity of the disease was much less than in the heavy epidemic of 1941.

An unusually heavy epidemic of the diseases associated with Helminthosporium sativum and Helminthosporium spp. occurred on barley. Seedling blight and root rot were general; heavy leaf and stem infections and head blight reduced yields appreciably. Scab (Gibberella zeae) (G. saubinettii) was heaviest in the southern part of the State. The pasmo disease, (Mycosphaerella linorum) (Sphaerella linorum) of flax reached unusual development, the most severe epidemic of this disease being recorded.

Late blight (Phytophthora infestans) on potatoes was less severe than in 1942 but was more prevalent than in most recent years. On rutabagas, leaf spot (Alternaria brassicae) (A. herculea) was common, and many of the roots in storage were infected.

Leaf-infecting pathogens were common on many hosts in 1943, bacterial leaf blight on oats and barley being very conspicuous. Lack of critical and experimental evidence on the losses resulting from most of such infections makes estimations of losses a matter of opinion.

VEGETABLE CROPS

BRASSICA CAMPESTRIS, RUTABAGA. Alternaria brassicae (A. herculea), Alternaria leaf spot and dry rot. Alternaria leaf spot was common in north central section of the State. Dry rot of the roots was seen in warehouses in Beltrami and Pine Counties. Fusarium sp., dry rot, was seen only in one warehouse in Beltrami County. Phoma lingam , black leg, was not abundant and loss was a trace. Loss from Xanthomonas campestris (Bacterium

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[1] The writer acknowledges his indebtedness for the assistance given to him during the course of the survey by E. C. Stakman, J. J. Christensen, M. B. Moore, C. J. Eide, C. M. Christensen, E. G. Sharvelle and Miss L. M. Dosdall of the University of Minnesota.

campestre), black rot, was especially severe in Pine County, about 15% being estimated.

BRASSICA OLERACEA var. CAPITATA, CABBAGE. Fewer reports of Xanthomonas campestris (Bacterium campestre), blackrot, were received in 1943 than in previous years. Loss was a trace, which is average.

Only a trace of Fusarium oxysporum f. conglutinans, yellows, was seen. Most commercial varieties grown are resistant. Phoma lingam, black leg, caused a trace of loss. Plasmodiophora brassicae, clubroot, is present in the principal cabbage regions of the State. Loss of 1% in 1943 is average.

CUCUMIS MELO, CANTALOUP. Only occasional infected plants by Erwinia tracheiphila) (Bacillus tracheiphilus), bacterial wilt, were seen. The estimated loss from Colletotrichum lagenarium, anthracnose, of 2% is about average but is less than for the 2 preceding years. The loss from Fusarium oxysporum f. melonis (F. bulbigenum var. niveum f. 2) is about the same as in previous years. Growers do not grow melons on land known to be infected. Loss from mosaic (virus) was limited to a trace.

CUCUMIS SATIVUS, CUCUMBER. The estimated loss of 1% from Erwinia tracheiphila), bacterial wilt, was about average. An average loss (5%) was estimated from mosaic (virus).

LYCOPERSICON ESCULENTUM, TOMATO. Colletotrichum phomoides, anthracnose, appeared late in the season. Phytophthora infestans, late blight, was much less prevalent than in 1942, only slight loss occurring. Septoria lycopersici, leaf spot, in the 1943 epidemic again was heavy, an estimated loss of 10% resulting.

Catface (non-parasitic) was seen most commonly in the vicinity of the Twin Cities, near Owatonna and Faribault in Southern Minnesota. The high soil moisture levels in the early summer of 1943 favored the development of leaf roll (non-parasitic). Many inquiries were received about this disease, but losses appeared to be slight.

PHASEOLUS VULGARIS, BEAN. Less anthracnose (Colletotrichum lindemuthianum) was seen in 1943 and loss was negligible. Less bacterial blight (due to Pseudomonas spp. and Xanthomonas spp.) developed in 1943 than in the previous year.

PISUM SATIVUM, PEA. Ascochyta blights (Ascochyta pisi, A. pinodella, and Mycosphaerella pinodes), were noted. Very little wilt (Fusarium oxysporum f. pisi race 1) (F. orthoceras var. pisi) was observed, for most varieties grown are resistant. Near wilt (Fusarium oxysporum f. pisi race 2) (F. oxysporum f. 8) has been reported by canning companies as becoming increasingly important. Somewhat less bacterial blight (Pseudomonas pisi) developed than in 1942.

SOLANUM TUBEROSUM, POTATO. The prevalence of Actinomyces scabies, common scab, in 1943 was about average, the disease remaining as one of the major potato problems in the State. A heavy epidemic of Alternaria solani, early blight, on the foliage occurred generally throughout the State, being most severe apparently on the lighter soils in the northern part of the Red River Valley. Occasional lots of tubers were heavily infected with tuber rot but loss from this phase of the disease was slight. Rejection of fields for certification was principally because of Cornyebacterium sepedonicum, bacterial ring rot, but infection in these fields was light.

Common stock is not infrequently infected but actual loss is light. Erwinia phytophthora (E. carotovora), black leg, was severe. Pellicularia filamentosa, (Corticium solani), black scurf, was less prevalent than usual. While Phytophthora infestans, late blight, was much less important in 1943 than in 1942, it still was more prevalent than in an average year. Loss from late blight was light. Loss from all virus diseases including leaf roll, mosaic, and spindle tuber, was average. Purple top wilt was most prevalent east of the Red River Valley and especially around Grand Rapids.

CEREALS, GRASSES, AND FORAGE CROPS

GRAMINEAE, (VARIOUS GRASSES). Claviceps purpurea, ergot, was found on many grasses throughout the State, commonly on Agropyron repens, and Bromus inermis, and not infrequently on Phleum pratense. Infection was heavier than in recent years.

AVENA SATIVA, OATS

Fusarium spp., Helminthosporium avenae, and other fungi, seedling blight and root rot, were common on oats in 1943 but losses are not known.

Pseudomonas (Phytomonas) coronafaciens, halo blight, was more prevalent in 1943 than in most years, the disease being very common early in the season. No estimate of loss was attempted.

Puccinia coronata, crown rust, occurred in a moderately heavy epidemic in 1943, but losses were much less than in 1941, when the grain was shrivelled from the heavy rust attack. A 3% reduction in yield was estimated. Vicland and Tama were resistant, Gopher and Minrus very susceptible.

Puccinia graminis avenae, stem rust, was more prevalent than in an average year. Vicland, Tama, and Nakota were resistant, although large pustules, indicating susceptibility to rust, were found on oats whose stem-rust resistance was derived from Richland. Gopher was very susceptible.

Ustilago avenae, loose smut, and U. kolleri (U. levis), covered smut. Loss from the smuts remained at the same level as in recent years. Vicland, Tama, and Nakota were resistant, and Gopher susceptible.

BROMUS INERMIS, BROME GRASS

Pseudomonas (Bacterium) coronafaciens var. atropurpurea, chocolate spot, was the most serious disease of brome grass in 1943. Selenophoma bromigena, leaf spot, was much less evident than in recent years.

DACTYLIS GLOMERATA, . ORCHARD GRASS

Colletotrichum graminicolum, anthracnose, was less common than in 1942.

HORDEUM VULGARE, BARLEY

Claviceps purpurea, ergot, was common but not important.

Fusarium spp., head blight; seedling blight and root rot;

Gibberella zeae (G. saubinetii), scab; seedling blight and root rot;

Helminthosporium spp., head blight; seedling blight, root rot;

Scab and head blight -- A general infection of scab and head blight reduced yields more than in an average year, the estimated reduction in yield from these diseases being 13%. Loss from scab was heaviest in the

southern half of the State, while head blight, resulting from infection by Helminthosporium sativum, was found more generally throughout the State. Head blight, resulting from infection by Fusarium spp., occurred only in the northern part of the State.

Any attempts to distinguish between the losses to barley from head blight resulting from infection by Gibberella, Helminthosporium, and Fusarium would be purely a matter of conjecture when readings are based on field observations. Accuracy in determining the proportion of blight due to any specific organism can only be obtained by adequate analysis of the seeds for microflora.

Seedling blight and root rot -- Seedling blight and root rot, resulting from the planting of seeds heavily infected with Gibberella zeae, Helminthosporium spp. and Fusarium spp. and Fusarium spp., was more widespread and destructive in 1943 than in most years. Especially good response (in stand and yield) resulted from fungicidal treatment of the seed.

Stem blight and foliage blotch. A very severe epidemic of stem blight and leaf blotch occurred throughout Minnesota in 1943, the disease being much more serious than in previous years. Helminthosporium spp. (particularly H. sativum) were chiefly responsible for the infections. All varieties grown were susceptible. Reduction in yield was estimated to be about 7%.

Helminthosporium gramineum, leaf stripe. Average loss (a trace) from leaf stripe was reported. Barbless and Glabron were resistant, Velvet and Peatland being susceptible.

Puccinia anomala, leaf rust, was general but damage was slight. Barbless and Velvet were susceptible.

Rhynchosporium secalis, scald, was present but apparently did not cause any loss.

Ustilago jensenii, covered smut. Loss from covered smut was recorded as trace. Barbless remained resistant.

Ustilago nuda, loose smut. While loss from loose smut was recorded as trace, the disease appears to becoming more common. Barbless, Velvet, and Glabron were susceptible, Trebi resistant, and Peatland resistant in the field but not when artifically inoculated.

Xanthomonas (Phytomonas) translucens, bacterial blight, was general throughout the State.

LINUM USITATISSIMUM, FLAX

Colletotrichum linicolum, Helminthosporium spp., Fusarium spp. and Rhizoctonia spp. causing seedling blight and root rot are of moderate importance in Minnesota and loss (estimated at 0.5%) in 1943 was average.

Fusarium oxysporum f. lini, wilt, is now of slight importance in Minnesota, the loss of 1% in 1943 being average. Some of the newer rust-resistant varieties, such as Viking and Bolley's Golden, are moderately susceptible to wilt.

Melampsora lini, rust, was less severe in 1943 than in many previous years, and was serious only in the northern part of the State. The recently developed variety, Koto, hitherto rust-resistant in field plots, was attacked very severely at the Crookston Station of the University of Minnesota. Other varieties, such as Bolley's Golden and Viking, retained their resistance to rust.

Mysphaerella linorum, pasmo. In 1943, the most severe epidemic of pasmo occurred. While the disease has been recognized for 27 years in the United States, this is the first year that losses from pasmo have been heavy. While the loss unquestionably was heavy, exact figures on the extent of the effect in yield are difficult to obtain. The yellow flaxes suffered more than the brown-seeded varieties, Viking and Bolley's Golden being very susceptible.

POA PRATENSIS, BLUEGRASS

Calonectria graminicola and Typhula itoana, snowmold, was common in the Twin City area on lawns, and was also reported from south-east Minnesota. Loss from this disease was relatively light in 1943, no heavy outbreak having occurred in Minnesota since 1941.

Helminthosporium vagans, leaf spot and crown rot, was common in July and August on lawns in Twin City area, and was seen on specimens submitted from southeastern part of the State. Reports indicated some loss to bluegrass pastures from this disease.

Puccinia poae-sudeticae, leaf rust, was much less prevalent than in the preceding 2 years. None was seen in pastures; it was observed only where bluegrass was uncut.

SECALE CEREALE, RYE

Less Claviceps purpurea, ergot, than usually developed, was seen.

Infection by Puccinia rubigo-vera var. secalis (P. dispersa) was light and no loss is reported.

Rye stem rust, (Puccinia graminis var. secalis) was found only near barberries.

SOJA MAX, SOYBEANS

Pre-emergence damping off and seedling blight due to Pythium sp. and probably other fungi is common on certain vegetable varieties to the extent that it is not possible to get satisfactory stands of some varieties, including Etum, Giant Green and some others, at University Farm, St. Paul. Other vegetable varieties, including Bansei and Chusei, have given good stands. Most oil and hay types are relatively resistant to seed decay.

While Xanthomonas phaseoli var sojense, bacterial pustule, is common, it did not cause any appreciable loss in 1943 and was much less destructive than in 1942.

Mosaic (virus) was most common in vegetable varieties.

SORGHUM VULGARE var. SUDANENSE, SUDAN GRASS

Pseudomonas holci, bacterial spot, occurred in most sudan grass fields but no apparent loss resulted.

TRITICUM AESTIVUM, WHEAT

Alternaria sp., Helminthosporium spp., and bacteria, black point, was most common and injurious on durum varieties and was as prevalent as in previous years.

While loss from Claviceps purpurea, ergot, did not exceed a trace, infection was not uncommon. Thatcher in the common wheats and Mindum in the

durums were the most susceptible of the commonly grown varieties.

Gibberella zeae (G. saubinetii), scab was very destructive in the corn area, from central Minnesota south, a 10% reduction in yield occurring. Thatcher and Mindum were very susceptible, and Minturki was the most resistant wheat.

Over much of the State, environmental conditions in the spring were unfavorable for good root development, with the result that seedling blight and root rot due to Helminthosporium spp., Fusarium spp., and other Fungi Imperfecti, were more severe than in an average year. A reduction in yield of 5% was estimated.

Puccinia graminis var. tritici, stem rust, caused very little loss, most of the wheat varieties grown being resistant.

Infection by Puccinia rubigo-vera var. tritici (P. triticina), leaf rust, was on about the same level as in most recent years, a reduction in yield of 5% resulting. Thatcher was very susceptible, and Rival and Mindum the most resistant.

Scattered infections of Septoria tritici, leaf blotch, were seen. The disease was common at the wheat breeding nursery at Waseca in south-east Minnesota, marked differences in the susceptibility of different lines of wheat being observed.

Infection by Tilletia foetida (T. levis) and Tilletia caries (T. tritici) bunt, remained on the same level as in recent years, a trace of loss being reported.

Very little Ustilago tritici, loose smut, was seen.

Xanthomonas translucens var. undulosa . black chaff, was not uncommon.

ZEA MAYS, CORN

Diplodia zeae and Fusarium spp. and other Fungi Imperfecti, stalk rot, ear rot, seedling blight and root rot. Stalk rot was somewhat more severe than in 1942, a loss in yield of about 2% resulting. Infection was general and marked differences in the amount of disease in different fields was observed. Much of the loss in yield resulted from stalk breakage.

Very little ear rot developed, loss being less than in an average year.

The poor seed crop of 1942 gave poor stands and weak plants in 1943. The estimated loss of 10% reduction in yield is much higher than is normally found in Minnesota. Seed treatment resulted in marked improvement in the stand and vigor of the plants.

The 2% loss in yield from Ustilago maydis (U. zeae), corn smut, represents an average loss for Minnesota. Many of the new hybrids are more resistant than old hybrids or standard varieties.

FRUIT CROPS

FRAGARIA spp., CULTIVATED STRAWBERRY. Dendrophoma obscurans, leaf scorch, caused no loss. Fusarium spp., Rhizoctonia sp. and probably other fungi, root rot, is most usually associated with winter injury making any estimate of loss difficult. Mycosphaerella fragariae, leaf spot, was somewhat more common in 1943, but loss was negligible.

MALUS SYLVESTRIS, APPLE. Erwinia amylovora, fireblight, was very prevalent in home orchards on Wealthy but of minor importance in commercial plantings.

Gymnosporangium juniperi-virginianae, apple-cedar rust, in a heavier than average attack caused much disfigured fruit in Hennepin and Ramsey Counties.

Venturia inaequalis, scab, affected almost all fruits in many unsprayed orchards, and many fruits in some well-sprayed orchards. The epidemic was rather more severe than in most years.

A fruit russetting, which always occurs to some extent on Haralson, was very prevalent on that variety in 1943.

PRUNUS spp., PLUMS AND CHERRY-PLUM HYBRIDS. Coccomyces hiemalis, leaf spot, is common on plums and cherry-plum hybrids. The disease appears in late July or August, causing some defoliation.

A heavier than average epidemic of brown rot blossom blight due to Monilinia (Sclerotinia) fructicola, caused severe injury to the plum-cherry variety Oka and to sand cherries in 1943.

RIBES sp., CURRANT. Sphaerotheca mors-uvae, powdery mildew, was severe on the Red Lake variety of currants in nursery stock in Southern Minnesota.

RUBUS spp., RASPBERRY. Elsinoë veneta, anthracnose, was somewhat more prevalent than usual. Sphaerulina rubi, leaf spot, was more prevalent in 1943 than in recent years. Loss from mosaic (virus) is light, most new plantings being relatively free from this disease.

MISCELLANEOUS HOSTS

BETA VULGARIS, SUGAR BEETS. Aphanomyces cochlioides, damping-off and root rot of sugar beets continues to spread in the beet area of southern Minnesota, and already is, or is becoming, a serious hazard in the production of sugar beets in McLeod, Sibley, Blue Earth, Waseca, and Faribault Counties. In Blue Earth County, 400 acres of beets were severely injured, with a probable reduction in yield of 40%.

Cercospora beticola, leaf spot, was found in all sugar beet areas of the State but did damage only in the southern beet area. Infection in the Red River Valley was light and late.

Damping off as a result of infection by Phoma betae is rarely seen.

Loss from Rhizoctonia solani causing damping-off and root rot is slight.

DELPHINIUM sp. Pseudomonas (Bacterium) delphinii, leaf spot, was reported once in 1943.

GAILLARDIA sp. Entyloma polysporum, white smut, was reported once in 1943, in the same city park in which the disease was found in 1942.

HEDERA sp., IVY. Oedema (cause unknown) was reported once in 1943; tiny galls, very numerous and conspicuous developed on a house plant.

IRIS sp. Heavy infections by Bacterium tardicresens, bacterial leaf blight occurred on some varieties and this disease is becoming troublesome in nurseries. Botrytis convoluta, Botrytis rhizome rot, was observed only in St. Paul area, with slight damage to the rhizomes. Very little Heterosporium gracile, leaf spot, was seen in the St. Paul area.

LILIUM spp. Very little blight caused by Phytophthora sp. developed in 1943 compared with the heavy epidemic of previous years. Lilium regale and L. tenuifolium are the most susceptible species.

PAEONIA sp. Very little Botrytis paeoniae, blight, developed in St. Paul area compared with the heavier infection in 1942. Occasional infections by Phytophthora sp, causing blight, were reported.

PETUNIA sp. One report was received of a house plant infected by Oidium sp., powdery mildew.

PINUS RESINOSA, RED PINE. Ten percent of an 8-year old stand of red pine planted in an area of Red Lake Indian Reservation, Beltrami County, was dying of root rot. Site and soil was said to be very good. The root systems were very small and entirely parasitised by Armillaria mellea. A similar dying of red pine was reported by the Soil Conservation Service from their nursery at Winona.

ROSA sp. Fewer reports of Phragmidium speciosum, rust, were received than in recent years.

SYRINGA VULGARIS, LILAC. Phytophthora sp., blight, was reported once in 1943.

SUMMARY OF PLANT DISEASES OBSERVED IN IOWA DURING 1943

T. W. Bretz

The following summary of estimates on the plant disease losses in Iowa for the year 1943 is based principally upon the information provided by the various State and Federal pathologists working in this territory. Owing to the rather late start of the Emergency Plant Disease Prevention Project, this summary would not be possible without the willing assistance of these men and the writer is duly grateful for their help. It should be borne in mind that this report is, of necessity, a record of the final crop loss estimates for the State as a whole and does not contain the trend of the plant disease situation during the growing season, nor the relative severity of the various diseases in different sections of the State.

The weather during the growing season was unusual in several respects. Whereas the precipitation and temperatures during April were about normal, May was unusually wet and the temperatures were below the average. The remaining months were characterized by precipitation and temperatures slightly above average. These conditions are perhaps reflected to some extent in the increased destructiveness of the root necrosis pathogens, as well as in certain other instances in which diseases were noticeably more serious than during the past few years.

VEGETABLE DISEASES

ALLIUM CEPA, ONION

Erwinia carotovora, soft rot, and Pseudomonas alliicola (thought to be the causal agent of the "undetermined neck rock" reported from Iowa in PDR Vol. 27, No. 16, p. 337, 1943) were estimated to have accounted for a combined loss of 25% of the crop. It is difficult to determine the extent of the losses caused by these organisms individually, since P. alliicola field

infection is commonly followed by the soft rot bacterium under storage conditions.

Urocystis cepulae, smut, varied in importance in different localities, but for the entire crop, was responsible for no more than a trace of damage.

APIUM GRAVEOLENS, CELERY

It was estimated that 20% of the celery grown in Iowa was lost due to the prevalence of 2 leaf spots, Cercospora apii (early blight), accounting for 10% loss, and Septoria apii (late blight) account for 10%, loss.

ASPARAGUS OFFICINALIS, ASPARAGUS

Puccinia asparagi, rust, was the only disease of importance observed during the season; it caused an estimated 2% reduction in yield.

BRASSICA OLERACEA var. CAPITATA, CABBAGE

No excessive losses due to disease were reported for this crop.

Alternaria circinans (leaf spot), Erwinia carotovora (soft rot), Fusarium conglutinans (yellows), Pellicularia filamentosa (Corticium vagum) (wire stem), Peronospora parasitica (downy mildew), Phoma lingam (blackleg) and Plasmodiophora brassicae (club root), were each responsible for a trace of damage.

Pythium spp., damping-off, was estimated to have been responsible for a 2% loss.

Xanthomonas campestris, black rot, accounted for the greatest loss, an estimated 5%.

CITRULLUS VULGARIS, WATERMELON

Colletotrichum lagenarium, anthracnose, was the most serious disease of watermelons this past season. Premature death of the vines due to foliage infection, plus fruit infection, accounted for an estimated 25% loss of the crop.

Fusarium oxysporum f. niveum, wilt, was held in check by the use of wilt-resistant varieties, but was responsible for a 5% loss.

Pythium acanthicum, blossom-end rot, caused an estimated 2% reduction in yield.

Pythium spp., damping-off, reduced the yield approximately 5% by decreasing the stand.

Mosaic, (virus), was responsible for a trace of damage.

CUCUMIS MELO, CANTALOUP

Alternaria cucumerina (Macrosporium cucumerimum), leaf blight, was severe and caused an estimated 5% reduction in yield.

Colletotrichum lagenarium, anthracnose, as with watermelon, was responsible for the greatest loss in cantaloups. Leaf infection, which caused an early death of the vines, as well as fruit infection, reduced the crop 20%.

Erwinia tracheiphila, bacterial wilt, resulted in a 5% loss.

Fusarium oxysporum f. melonis (F. bulbigenum var. niveum f. 2), wilt resulted in a 5% loss.

Pythium spp., damping-off, through its effect on stand, reduced the crop approximately 3%.
Mosaic (virus) accounted for a trace in reduction in yield.

DAUCUS CAROTA, CARROT
Erwinia carotovora, soft rot, was estimated to have caused a 5% loss in yield.
Xanthomonas carotae, bacterial spot, was observed but considered to be of minor importance, causing a trace of damage.

IPOMOEA BATATAS, SWEETPOTATO
Endoconidiophora (Ceratostomella) *fimbriata*, black rot, was considered to be a disease of minor importance and caused an estimated loss amounting to a trace of the crop.
Fusarium oxysporum f. *batatas* (F. batatatis and F. hyperoxysporum), stem rot (wilt), continued to be the major disease in the field as in former years, causing an estimated 10% loss.
Fusarium oxysporum (surface rot) and *Pythium ultimum* (mottle necrosis) each accounted for a trace of damage.
Rhizopus nigricans, soft rot and ring rot, was the most important disease in storage, accounting for a 15% loss.
Internal breakdown, physiological, accounted for a loss amounting to a trace of the harvested crop.

LYCOPERSICON ESCULENTUM, TOMATO
Alternaria solani, early blight, was prevalent in most plantings to a rather limited extent and was estimated to have accounted for a trace of damage.
Fusarium oxysporum f. *lycopersici* (F. bulbigenum var. lycopersici), wilt. The increased use of wilt-resistant varieties tended to keep down the losses from this disease, estimated to be 1%.
Phytophthora infestans, late blight, was observed in a few isolated plantings late in the season, but caused no appreciable loss. A trace of damage was reported.
Septoria lycopersici, blight, was the most prevalent and serious disease of tomatoes, resulting in much defoliation by late summer. In many instances the disease did not become well established, however, until after the fruit had set and was maturing. The loss due directly to this disease was estimated at 10%.
Xanthomonas vesicatoria, bacterial spot, was present in most of the commercial tomato acreages but caused relatively little loss, an estimated 0.5%.
Fruit rots, were caused by miscellaneous fungi and bacteria, following injuries to the fruit. Sunscald, resulting from defoliation due to Septoria blight, was undoubtedly an important forerunner of much of this decay. At least 25% of the fruits rotted in the fields.
Mosaic (virus) was reported from various parts of the State, but in no instance was it particularly serious. An estimated 2% loss was attributed to it.
Blossom end rot, physiogenic, was prevalent early in the season on the

fruit of the first clusters set, but considering the entire season it was not a serious problem, causing a 1% reduction in yield.

PHASEOLUS VULGARIS, BEAN

Colletotrichum lindemuthianum, anthracnose, was the most prevalent and destructive disease of beans, reducing the yield an estimated 10%.

Uromyces phaseoli, rust, was of minor importance, causing only a trace of damage.

Xanthomonas phaseoli, bacterial blight, was prevalent and serious in some plantings, causing an average reduction in yield of 5%.

Mosaic (virus) was common but not a serious problem, accounting for an estimated 1% loss.

PISUM SATIVUM, PEA

Except for the root rots, the pea was not affected by any disease to a serious degree.

Aphanomyces sp., Fusarium sp., Pythium sp., and Rhizoctonia solani, as well as other pathogens causing root rot, were estimated to have caused a 5% loss in the pea crop.

SOLANUM TUBEROSUM, POTATO

An estimated 46.7% of the potato crop was lost due to diseases.

Actinomyces scabies, scab, was responsible for a 10% reduction in yield. Its severity varied from field to field. Some fields were practically scab-free; in others practically all tubers showed scab lesions.

Alternaria solani, early blight, was observed to a limited extent in most of the potato acreages but was of minor importance, causing a trace of damage.

Erwinia phytophthora (E. carotovora), black leg, did not appear to be of major importance, accounting for 0.5% loss.

Fusarium solani f. eumartii, Fusarium wilt, was observed affecting an occasional plant, causing a trace of damage.

Phytophthora infestans, late blight, again occurred in epiphytotic proportions on the muck-land potatoes in northern Iowa. The severity of the outbreak depended to a great extent upon the effectiveness with which the fields were protected by means of spraying. Fields that were well sprayed showed little loss, but poorly sprayed or unsprayed fields in many instances showed as much as 50% reduction in yield. For the State, including all situations, it was estimated that the loss amounted to 16% of the crop.

Rhizoctonia solani, black scurf, varied greatly in severity from field to field. An estimated 6% loss was attributed to it, somewhat more than last season.

Seed piece decay, various organisms responsible, caused an estimated loss of 1%.

Leaf roll (virus) was fairly common and caused an estimated 2% loss.

Mosaic (virus) was thought to have reduced the yield 2%.

Spindle tuber (virus) was fairly prevalent and caused an estimated reduction in yield amounting to 3%.

Other viruses probably reduced the yield an additional 2%. Tipburn and

hopperburn were general and in some fields destructive, causing an average loss estimated at 4%.

DISEASES OF CEREALS, GRASSES, AND FORAGE CROPS

AVENA SATIVA, OATS

The estimated losses in the oat crop due to all diseases amounted to 33.2%, distributed as follows:

Fusarium sp., foot rot, 1%.

Gibberella zeae (G. saubinettii), scab, a trace.

Helminthosporium avenae, leaf spot, a trace.

Pseudomonas coronafaciens, halo blight, 1.5%.

Pythium spp., root necrosis, 10%. This is somewhat higher than in previous years and is probably accounted for by the favorable conditions for development of Pythium early in the season.

Puccinia coronata, crown rust, 10%. This was a favorable season for rust development, which accounts for a higher loss than was experienced the preceding season, despite the greater use of the available rust-resistant oat varieties (Boone, Tama, Control, and Marion).

Puccinia graminis var. avenae, stem rust, 5%, which is considerably more than in previous years.

Ustilago avenae, loose smut, 1.5%, a reduction as compared with previous years, probably accounted for by the wider use of the new oat varieties which are somewhat smut-resistant.

Ustilago kolleri (U. levis), covered smut, 0.5%.

Blast, physiological, 0.5%.

Leaf spot, physiological (?), 3%.

BROMUS spp., BROMEGRASS

The yield of bromegrass was reduced an estimated 42.7% because of disease.

Claviceps purpurea, ergot, accounted for 1% of this loss.

Pseudomonas coronafaciens var. atropurpurea, bacterial spot, reduced the yield an estimated 1.5%.

Puccinia graminis, stem rust, caused a trace of damage.

Pythium spp., root necrosis, accounted for the greatest reduction in an estimated 33%.

Stagonospora sp., purple leaf spot, was estimated to be responsible for a 5% loss.

Xanthomonas translucens, bacterial streak, was responsible for a 3% loss.

Phyllody, (cause ?), caused a trace of damage.

HORDEUM VULGARE, BARLEY

Diseases were estimated to have reduced the yield of barley 40.9% in spite of an otherwise favorable season for this crop.

Claviceps purpurea, ergot, was more prevalent than in the past and accounted for a trace of damage.

Erysiphe graminis var. hordei, powdery mildew, was observed but considered to be of minor importance, the loss resulting amounting to a trace.

Gibberella zeae (G. saubinettii), scab, was somewhat more prevalent than in the preceding 3 years, causing an estimated 3% reduction in yield.

Helminthosporium gramineum, stripe, as in former seasons, was present but accounted for only a trace of damage.

Helminthosporium sativum, spot blotch, was an exceptionally serious problem and including the seedling blight phase of this disease, was estimated to have reduced the yield 25%. Extremely heavy nodal infection was observed, resulting in the death of the leaf sheaths before the plant was in the boot stage of development.

Helminthosporium teres, net blotch, was observed and estimated to have resulted in a loss amounting to a trace of the crop.

Helminthosporium sp., Fusarium sp. and Ophiobolus sp., foot rots, appeared to be of less importance than in former years, accounting for a 0.2% reduction in yield.

Puccinia anomala, leaf rust, was estimated to have reduced the yield 1%.

Puccinia graminis, stem rust, reduced the yield an estimated 0.5%.

Puccinia rubigo-vera var. tritsici (P. triticina), wheat leaf rust, was of negligible importance on barley reducing the yield a trace.

Pythium spp., root necrosis, favored by the weather conditions, was estimated to have accounted for a loss of 8%.

Ustilago intermedia, intermediate smut, was somewhat more common and reduced the yield approximately 0.5%.

Ustilago jensenii (U. hordei), covered smut, was the least prevalent of the smuts and caused a reduction in yield amounting to a trace.

Ustilago nuda, loose smut, was the most serious of the smuts and accounted for an estimated 2% reduction in yield.

Xanthomonas translucens, bacterial blight, was considered to be of minor importance, the loss resulting from this disease amounting to a trace.

LINUM USITATISSIMUM, FLAX

Diseases accounted for an approximate reduction in yield amounting to one-third of the crop.

Colletotrichum linicola, anthracnose, accounted for a trace of damage.

Fusarium oxysporum f. lini, wilt, was of relatively little importance as a result of the wide use of the wilt-resistant varieties. An estimated 1% loss was attributed to this disease.

Melampsora lini, rust, was estimated to have caused a 0.5% loss.

Mycosphaerella (Sphaerella) linorum, pasmo, was prevalent and moderately severe, causing a 5% loss.

Pythium spp., causing root necrosis and damping-off, was the most serious disease problem and accounted for the greatest loss, an estimated 25%.

MEDICAGO SATIVA, ALFALFA

It was estimated that the yield of alfalfa was reduced about one-third as a result of the prevalence of certain diseases.

Cercospora medicaginis, leaf spot, was common and accounted for an estimated 1% loss.

Corynebacterium insidiosum, wilt, was the most destructive disease observed, accounting for a 20% reduction in yield.

Peronospora trifoliorum, downy mildew, was considered to be of minor importance, causing a trace of damage.

Pseudopeziza medicaginis, leaf spot, was common and severe, causing an estimated 6% loss.

Pyrenopeziza medicaginis, yellow leaf blotch, was estimated to have reduced the yield 4%.

Uromyces striatus, rust, was observed but was considered to be of minor importance, causing a trace of damage.

PHLEUM PRATENSE, TIMOTHY

Puccinia graminis var. phlei-pratensis, stem rust, was considered to be of minor importance, causing a loss amounting to a trace of the crop.

Scolecotrichum graminis, leaf stripe, was the most prevalent and destructive of the timothy diseases, causing an estimated 1% loss.

Ustilago striaeformis, stripe smut, was of minor importance, accounting for a trace of damage.

Xanthomonas translucens var. x, bacterial leaf spot, was observed and estimated to have accounted for a trace of damage.

POA PRATENSIS, BLUEGRASS

Erysiphe graminis, powdery mildew, was responsible for a trace of damage.

Puccinia graminis, stem rust, caused an estimated 1% loss.

Septoria macropodia, leaf spot, caused a trace of damage.

SECALE CEREALE, RYE

This crop appeared to be relatively free of destructive diseases.

Claviceps purpurea, ergot, was more prevalent than in former years, causing an estimated 1% loss.

Puccinia rubigo-vera var. secalis (P. dispersa), leaf rust, was prevalent and accounted for a 2% reduction in yield.

Puccinia graminis, stem rust, was of minor importance, a trace of damage being reported.

Ustilago sp., smut, caused a trace or damage.

Xanthomonas translucens var. secalis, bacterial blight, was observed but considered to be of minor importance, causing a trace of damage.

SOJA MAX, SOYBEAN

Diaporthe sojae, pod and stem blight, was reported from all sections of the State and was present in a high percentage of the fields, but the actual damage caused by this disease was estimated not to exceed 0.5%.

Glomerella glycines, anthracnose, was found in all sections of Iowa but in relatively few fields, usually occurring on plants affected by some other disease and in a poor state of vigor. Only a trace of damage was attributed to this organism.

Peronospora manshurica, downy mildew, appeared rather late in the growing season in a limited number of fields and probably affected the yield to a negligible extent. A trace of damage was recorded.

Pseudomonas glycinea, bacterial blight, was prevalent in practically all fields. The amount of leaf area involved by the lesions was relatively small, however, and the disease was thought to have reduced the yield an estimated 0.5%.

Pythium spp., root necrosis, was probably responsible for a limited reduction in stand, but owing to the thick seeding practiced in planting this crop, the loss was largely compensated for by the increased vigor of the remaining plants. An estimated loss of 1% was attributed to this disease.

Rhizoctonia solani, damping-off. As in the case of root necrosis, the loss in stand due to this disease was not necessarily reflected in a corresponding decrease in yield, and a 1% reduction in yield was recorded.

Septoria glycines, Septoria leaf spot, was observed early in the growing season but did not persist as an important factor in limiting yield, being responsible for an estimated 0.5% reduction.

Xanthomonas phaseoli var. sojense, bacterial pustule. This undoubtedly was the most prevalent and serious disease of soybeans. It was observed in all fields in every section of the State, causing much leaf spotting and some defoliation. It was estimated to have caused a loss in yield amounting to 2%.

Bud blight was widely distributed throughout the State. The percentage of plants affected in individual fields varied from a trace to 100% and the severity of the disease was correspondingly varied. Relatively few fields were observed in which there was a serious reduction in yield and for the State the loss did not exceed 1%.

Mosaic (virus) was observed in a relatively small percentage of the fields and in only a few instances did it appear that there was a marked reduction in yield resulting. A loss to the extent of a trace was recorded for this disease.

The late planted fields and fields planted to late-maturing varieties were hit by frost, particularly in the northern counties, before the crop was fully matured, resulting in an estimated 2% reduction in yield.

SORGHUM VULGARE, SORGHUM

Pseudomonas holci, bacterial spot, was common but of minor importance, causing a trace of damage.

Sphacelotheca sorghi and S. cruenta, kernel smuts, accounted for an estimated 1% reduction in yield.

TRIFOLIUM PRATENSE, RED CLOVER

Erysiphe polygoni and Cymadothea trifolii, powdery mildew and sooty mold, respectively, each accounted for a trace of damage.

Pseudomonas syringae (P. trifoliorum), Pseudopeziza trifolii, and Stagonospora sp., the leaf spotting organisms, caused a combined loss estimated at 3%.

Mosaic (virus) was responsible for a trace of damage.

TRITICUM AESTIVUM, WHEAT

Gibberella zeae (G. saubinetii), scab, was unusually severe on winter wheat, causing a 12.5% reduction in yield. It was less destructive than last season on the spring wheat, however, causing a 5% loss.

Puccinia graminis var. tritici, stem rust, although somewhat more prevalent than last year, was not particularly serious except in localized areas, causing loss ranging from a trace to 25%. It was estimated to have reduced the average yield of winter wheat 3%, and of spring wheat only a trace.

Puccinia rubigo-vera var. tritici (P. triticina), leaf rust, was the most destructive disease observed and was somewhat more severe than usual on the winter wheat, causing a 10% loss. It appeared to be less serious than last season on the spring wheat, reducing the yield 15%.

Pythium spp., root necrosis, was somewhat more prevalent and serious than in previous seasons, causing an estimated 10% loss in the winter wheat crop.

Septoria tritici, speckled leaf blotch, was of minor importance, causing a 1% loss in the winter wheat and a trace of damage in the spring wheat.

Tilletia foetida (T. laevis) and T. caries (T. tritici), bunt, caused a trace of damage.

Ustilago tritici, loose smut, appeared to be no more destructive than in former years, accounting for a 2% and a 0.5% reduction in yield in the winter and spring wheats, respectively.

Xanthomonas translucens var. undulosa , black chaff, was observed on winter wheat but was considered to be responsible for only a trace of damage.

ZEA MAYS var. IDENTATA, FIELD CORN

Much of the corn was subject to very unfavorable weather early in the season, which was reflected to some extent by a general increase in the amount of root necrosis due to various pathogens. The other diseases were not noticeably more serious than in previous seasons, except for an increased prevalence of Gibberella ear rot.

Cephalosporium acremonium, black bundle, was observed and caused a trace of damage.

Diplodia zeae, root necrosis, was prevalent and caused a 2% loss. The dry rot phase of the disease accounted for an estimated 5% reduction in yield.

Fusarium spp., dry rot, was prevalent, particularly following corn earworm damage, but was considered to have caused only a trace of damage.

Gibberella zeae (G. saubinetii), caused an estimated 5.6% loss. The root necrosis phase of the disease accounted for a 2% reduction; the stalk rot phase 1% and the dry rot of ears, 2.6%.

Nigrospora oryzae, dry rot of ears, was prevalent, particularly on secondary ears, but was of minor importance on primary ears, causing an estimated 0.5% loss.

Puccinia sorghi, leaf rust, was common in all sections of the State but in no instance did it occur in destructive proportions. A trace of damage was reported.

Pythium spp., root necrosis, was prevalent and destructive, causing an estimated 10% reduction in yield.

Ustilago zeae, smut, was prevalent in all fields in varying amounts, causing an average decrease in yield estimated at 3%.

ZEA MAYS var. RUGOSA, SWEET CORN

Bacterium stewarti, bacterial wilt, was of minor importance, causing a trace of damage.

Diplodia zeae, stalk rot, was generally prevalent and destructive, causing an estimated 5% loss.

Puccinia sorghi, rust, was prevalent but caused only a trace of damage.

Ustilago zeae, smut, was the most destructive disease observed, accounting for an estimated 8% reduction in yield.

FRUIT DISEASES

AMYGDALUS PERSICA, PEACH

Owing to the lack of adequate means of applying protectants in the farm and home orchards, combined with the favorable weather conditions for disease development, the losses are somewhat higher than in previous years.

Cladosporium carpophilum, scab, was generally prevalent and reduced the yield an estimated 3%.

Monilinia (Sclerotinia) fructicola, brown rot, was the most serious disease problem encountered and caused an estimated 15% reduction in yield.

Sphaerotheca pannosa var. persicae, powdery mildew, was observed but considered to be of minor importance, causing a trace of damage.

Taphrina deformans, leaf curl, appeared to be somewhat more pronounced this season than last, reducing the yield an estimated 2%.

Xanthomonas pruni, bacterial blight, was quite destructive, causing an estimated 5% loss.

FRAGARIA, STRAWBERRY

Botrytis sp., Phytophthora cactorum, and Rhizoctonia sp., causing field fruit rots, were prevalent and accounted for the greatest disease loss, an estimated 10%.

Mycosphaerella fragariae, leaf spot, was also more prevalent than in previous years and reduced the yield an estimated 4%.

Sclerotinia sclerotiorum, crown rot, was of minor importance, accounting for 0.5% loss.

Mosaic, virus (?), (thought to be different from June yellows) has been observed, but was considered to be of minor importance and responsible for only a trace of damage. The late spring freezes were estimated to be responsible for a 10% loss in yield.

MALUS SYLVESTRIS, APPLE

Approximately one-third of the apple crop was estimated to have been destroyed by diseases the past season. Most of this loss occurred in the farm and home orchards where adequate protection from disease was not practicable.

Erwinia amylovora, fire blight, was generally prevalent in all plantings and caused an estimated 2% loss.

Gloedes pomigena, sooty blotch, was of rather minor importance and reduced the yield about 0.5%.

Glomerella cingulata, bitter rot, was not common and accounted for only a trace of damage.

Gymnosporangium juniperi-virginianae, cedar-apple rust, was common on the susceptible varieties and caused an estimated 2% reduction in yield.

Nummularia discreta, blister canker, was not serious, causing an estimated 0.5% loss.

Phyllosticta solitaria, blotch, was not generally prevalent and caused only a trace of damage.

Physalospora obtusa, black rot, was somewhat more serious than in previous seasons and accounted for a 4% reduction in yield.

Venturia inaequalis, scab, was the most destructive disease, especially in unsprayed or poorly sprayed orchards, causing a loss estimated at 15%.

Winter injury was estimated to have reduced the yield 10%.

PRUNUS spp., CHERRY

Owing to the fact that few cherries are grown commercially in this State and that farm and home orchards are generally not adequately protected from disease, the losses from controllable diseases are rather high.

Coccomyces hiemalis, leaf spot, was the most destructive disease, accounting for much early defoliation. It was estimated to have reduced the yield 20%.

Podosphaera oxyacanthae, powdery mildew, was more prevalent and destructive than in previous seasons, accounting for an estimated 10% loss.

Monilinia (Sclerotinia) fructicola, brown rot, appeared to be less serious than in former years, causing a 1% reduction in yield.

The late spring freezes were of importance in reducing the set of fruit and accounted for an estimated 10% loss.

PRUNUS spp., PLUM

Dibotryon morbosum, black knot, was observed but was of minor importance, causing a trace of damage.

Monilinia (Sclerotinia) fructicola, brown rot, was generally prevalent and a serious problem, accounting for an estimated 10% reduction in yield.

Taphrina pruni, plum pockets, was estimated to have reduced the yield 1%.

Xanthomonas pruni, bacterial blight, was prevalent and serious, causa 10% loss.

RIBES spp., CURRANT AND GOOSEBERRY

Cercospora angulata, leaf spot, was prevalent and caused an estimated 2% loss.

Cronartium ribicola, European currant rust, was present in scattered localities, accounting for a trace of damage.

Mycosphaerella grossulariae, leaf spot, was generally distributed and caused a 2% loss.

Puccinia grossulariae, cluster-cup rust, was observed in scattered locations, causing a trace of damage.

Sphaerotheca mors-uvae, powdery mildew, was prevalent and accounted for an estimated 2% loss.

RUBUS spp., RASPBERRY

Agrobacterium tumefaciens, crown gall, was present in some plantings and accounted for a 1% loss.

Elsinoë veneta, anthracnose, was the most prevalent and destructive fungous disease observed, in some instances destroying practically the entire stand. For the State it was estimated to have caused a 7% loss.

Gymnoconia peckiana (G. interstitialis), orange rust, caused a loss estimated at 1%.

Leptosphaeria coniothyrium, cane blight, was generally distributed, accounting for an estimated 3% loss.

Mycosphaerella rubina, leaf spot, was general but not serious, causing only a trace of damage.

Septoria rubi, leaf spot, was common and accounted for a 3% reduction in yield.

Winter injury was estimated to have caused a 1% loss.

Mosaic, (virus), was prevalent and destructive, accounting for an estimated 7% reduction in yield.

VITIS spp., GRAPE

Owing to the difficulty in keeping the vines adequately protected because of the frequent precipitation, the losses in this crop were considerably greater than in previous years.

Guignardia bidwellii, black rot, and Plasmopora viticola, downy mildew, were each estimated to have caused a 5% loss.

The late spring freezes were thought to have reduced the yield an additional 5%.

DISEASES OF MISCELLANEOUS HOSTS

BETA VULGARIS, SUGAR BEET. Disease losses accounted for 45.4% of the crop.

Actinomyces scabies, scab, was responsible for only a trace of damage.

Aphanomyces cochlioides, root rot, favored by soil conditions conducive to its development, caused an estimated reduction in yield amounting to 20%.

Cercospora beticola, leaf spot, was favored by the moist weather and accounted for a 12% loss of the crop, somewhat higher than in previous seasons.

Phoma betae, root rot and leaf spot, each accounted for a trace of damage.

Pythium spp., damping off, was estimated to be responsible for a 10% loss, somewhat above the average of past seasons.

Rhizoctonia solani, root rot, was more severe than usual, causing an estimated 3% loss.

Savoy disease (virus) accounted for a trace of damage.

HELIANTHUS ANNUUS, SUNFLOWER. Erisyphe cichoracearum (powdery mildew) and Puccinia helianthi (rust), were generally prevalent and each accounted for an estimated 2% loss.

JUNIPERUS VIRGINIANA, REDCEDAR

Gymnosporangium juniperi-virginianae, rust, was common but accounted for only a trace of damage.

Phomopsis sp., blight, appeared to be an increasingly important disease and was observed affecting many nursery plantings. An estimated 5% of this nursery stock was considered to be affected to the extent that even after pruning, the trees would have no sale value.

ROSA spp., ROSE. Agrobacterium tumefaciens, crowngall, was estimated to be responsible for a loss of 1%. Diplocarpon rosae, black spot, was general, the severity varying with protective measures applied. It was estimated to have caused a 5% loss. Sphaerotheca humuli and S. pannosa were prevalent and estimated to have caused 5% damage.

ULMUS AMERICANA, AMERICAN ELM. Gnomonia ulmea, leaf spot, was generally distributed and caused moderate damage through defoliation.

ULMUS PARVIFOLIA, LEATHERLEAF ELM. Gnomonia ulmea, leaf spot, was severe and responsible for much defoliation by midsummer.

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PLANT DISEASE SURVEYS IN THE SOUTHEASTERN UNITED STATES IN 1943

June 15, 1944

PLANT DISEASE SURVEYS

IN THE SOUTHEASTERN UNITED STATES IN 1943

Plant Disease Reporter
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EMERGENCY PLANT DISEASE SURVEY IN VIRGINIA 1943

Carlton F. Taylor

Work on the Emergency Plant Disease Prevention Project was started in Virginia in August, 1943. At that time small grains had already been harvested, as had early season vegetables, and only midsummer and autumn crops were available for observation. This report is confined largely to those diseases seen by the writer. The two exceptions are the information drawn from an unpublished report by Dr. G. K. Parris and Mr. H. W. Ridgway on a survey of tomato diseases on the Eastern shore of Virginia, and a report on tobacco diseases in Virginia prepared for the writer by Dr. W. A. Jenkins.

Crop losses reported are estimates, based on counts or the writer's estimate in conjunction with the estimates of pathologists, County Agents, and growers. Percentage losses are reported only where the writer had reason to believe that sufficient information was at hand to make the report reasonably accurate.

The identity of many of the fungi was either determined or confirmed by Dr. Leland Shanor on the basis of material forwarded him by the writer.

VEGETABLE CROPS

ASPARAGUS OFFICINALIS, ASPARAGUS. Cercospora asparagi was abundant on the stems of 70% of the plants in one field.

BRASSICA CAMPESTRIS, RUTABAGA. Boron deficiency was found to be causing considerable loss in one locality in western Virginia. In this locality from 500 to 600 acres of rutabagas are produced annually to be marketed in late August and early September. In 1943 approximately 10% (estimate by the dealer and by the County Agricultural Agent) of the acreage suffered from boron deficiency. This represented practically a 10% market loss since no means of removing all affected roots from a lot was known, hence roots from affected fields were not marketed.

BRASSICA OLERACEA var. BOTRYTIS, BROCCOLI. Peronospora parasitica (downy mildew) was observed on most of the older leaves in two fields.

Mosaic was present as a trace in one field.

BRASSICA OLERACEA var. CAPITATA, CABBAGE. Alternaria circinans (A. brassicae) was very prevalent in western Virginia. This infection developed late in the season so that appreciable loss is doubted. It was observed in one field in eastern Virginia. Fusarium oxysporium f. conglutinans (yellows) was of rare occurrence. In one large field approximately 30% of the plants had been affected. Peronospora parasitica (downy mildew) was found on cabbage leaves in several fields but was causing little loss. Xanthomonas campestris (black rot) was found as a trace in one field.

CAPSICUM FRUTESCENS, PEPPER. Pseudomonas solanacearum was suspected to be the cause of death of several plants in one field. Mosaic (virus) was observed in several fields, different sections of one field varying from 2 to 20% of the plants affected.

CUCURBITA PEPO var. CONDENSA, SUMMER SQUASH. Erysiphe cichoracearum (powdery mildew) was observed as a trace in one field. Pseudoperonospora cubensis (downy mildew) was observed in one field, but appeared to have caused little loss.

DAUCUS CAROTA, CARROT. Alternaria carotae (leaf blight) was observed in many gardens. All specimens examined microscopically yielded this fungus.

IPOMOEA BATATAS, SWEETPOTATO. Actinomyces ipomoeae (pox) was observed occasionally as causing little damage. Fusarium sp. (blue stem) had caused a moderate loss in yield in one field. Stem infection was severe in this field. Monilochaetes infuscans (scurf) had affected at least 15% of the roots in one field and was general in other fields. Phyllosticta batatas (leaf spot) was abundant, but seemed to be causing little damage. Rhizopus nigricans (soft rot) was causing a follow-up rot in many roots affected with blue stem.

LYCOPERSICON ESCULENTUM, TOMATO.

Alternaria solani (early blight) was severe in all early-planted fields, leaf spots having caused from 50 to 90% defoliation when harvest was approximately two-thirds completed. The yeild loss probably approached 10%.

Fusarium oxysporium f. lycopersici (wilt) was a major disease in eastern Virginia. Here the Rutgers variety is used widely. However, the frequent occurrence of varietal mixtures made it difficult to correlate the wilt positively with the Rutgers variety.

Phytophthora infestans (late blight) was distributed widely in southwestern Virginia. Both leaves and fruits were affected, though the fruit rot phase was seen more commonly. The highest infection observed was one of 10% of the fruit and 2% of the leaves.

Phytophthora parasitica (buckeye rot) was observed much more rarely than the late blight rot and appeared to have caused little loss.

Sclerotium rolfsii (southern blight) was an important cause of loss in eastern Virginia. Losses ranged from 3 to 80% of the plants (Parris).

Septoria lycopersici (leaf spot) was much less damaging than the Alternaria spot throughout the State.

Mosaic (virus)-infected plants were observed in many fields. In a few fields a high percentage of the plants were infected. In one field both the common tobacco strain and cucumber mosaic were abundant. By October these viruses had spread until most of the plants showed symptoms of both diseases.

Blossom-end rot (non-parasitic) affected possibly 5% of the crop in western Virginia.

PETROSELINUM CRISPUM, PARSLEY

Heterodera marioni (rootknot) had caused about 10% loss in one field of young parsley plants.

PHASEOLUS VULGARIS, BEAN.

Bacterial blight (specific type not determined) was observed occasionally, in no case was it observed to be causing measurable loss.

Colletotrichum lindemuthianum (anthracnose) was observed in all portions of the State, but was causing heavy loss in only a few small plantings in western Virginia.

Erysiphe polygoni (powdery mildew) was found as a trace in many fields. In one 6-acre field all leaves and some of the remaining pods were attacked heavily. However, loss was slight as most of the crop had been harvested before the infection became severe. Loss for the state was negligible.

Uromyces phaseoli var. *typica* (rust) was common in home plantings, usually being more severe on unnamed home grown varieties. It was present as a trace in several commercial plantings.

Rootknot (*Heterodera marioni*) was of general occurrence, in one field being responsible largely for a yeild difference of 50 bushels as compared with 300 bushels per acre in 2 fields on the same farm.

Mosaic (virus) was frequently seen, affecting as high as 5% of the plants in some fields.

SOLANUM MELONGENA, EGGPLANT. *Fusarium* sp. (wilt) had caused vascular discolorations in 50% of the plants in one field, many of these plants being wilted. *Phomopsis vexans* (fruit rot) was present on nearly 50% of the fruits in one field in October, the owner estimating a loss of about 25% from this cause during the season.

SOLANUM TUBEROSUM, POTATO. *Phytophthora infestans* (late blight) was observed as a trace in a very few of the fields observed. The mountainous area in the 5 western counties was not visited. Leaf roll, mosaic, and spindle tuber (virus) were prevalent and causing yield reduction in eastern Virginia. In one field a few plants were seen which showed symptoms typical of yellow dwarf.

SPINACIA OLERACEA, SPINACH. *Peronospora effusa* (downy mildew) had not developed in eastern Virginia at the end of October. Reports received from this section indicate that in November a moderate infection of this disease had developed.

CEREAL AND FORAGE CROPS

SOJA MAX, SOYBEAN. *Alternaria* sp., *Cercospora sojina*, and *Phyllosticta glycineum* were identified from material collected in a field suffering severely from leaf spots in eastern Virginia. *Xanthomonas phaseoli* var. *sojense* (bacterial pustule) was observed on soybeans in all sections of Virginia. In most cases the loss was considered to be slight.

SORGHUM VULGARE, SORGHUM. *Helminthosporium turcicum* was prevalent in a field in eastern Virginia.

TRITICUM AESTIVUM, WHEAT. *Puccinia graminis tritici* (stem rust), on the basis of straw stacks seen and on the reports of growers, was very severe in sections of western Virginia. Yields as low as 5 bushels per acre were reported, allegedly due mostly to the attacks of stem rust.

VIGNA SINENSIS, COWPEA. *Amerosporium oeconomicum* (leaf spot) was abundant in one field observed in southeastern Virginia.

ZEA MAYS, FIELD CORN. *Helminthosporium maydis* was identified by Dr. Leland Shanor from leaf lesions collected in southeastern Virginia. *Helminthosporium turcicum* was identified as the cause of a larger leaf lesion in the same field. The total injury caused by Helminthosporium leaf blight varied considerably with varieties in a hybrid corn trial at Holland. Since, in the records taken in these plots, no attempt was made to distinguish between the 2 types of leaf lesions, it is not possible to determine whether the 2 species had similar varietal reactions.

FRUIT CROPS

AMYGDALUS PERSICA, PEACH. Monilinia fructicola (brown rot) was of extremely rare occurrence. Yellows (virus) was observed as affecting a few trees in northern Virginia. One affected tree was observed near Hansonville in southwestern Virginia. Drought during midsummer tended to reduce the size of the fruit and was an important factor in reducing losses caused by brown rot. Frost during the spring caused complete destruction of the crop in many orchards and was responsible for a very light crop in the State.

MALUS SYLVESTRIS, APPLE. Corticium galactinum (white root rot) was tentatively diagnosed as the cause of death of two trees examined. Erwinia amylovora (fire blight) was much less abundant than during the past few years. Glomerella cingulata (bitter rot) had affected approximately 10% of the Grimes Golden apples in a close-planted, poorly-sprayed block. It was seen in no other orchard. Gymnosporangium juniperi-virginianae (rust) was observed in many apple orchards. It ranged from slight to severe leaf infections, in a few instances having caused sufficient defoliation to have reduced the fruit size. Physalospora obtusa (black rot) was observed as a trace in a few orchards. Venturia inaequalis (scab) caused a considerable loss in unsprayed or poorly-sprayed orchards, but was unimportant in well-sprayed orchards. Xylaria mali (black root rot) was found to be killing trees in 4 of 6 3-to 13-year orchards examined in Clark and Frederick Counties. A total of 16 trees of approximately 5260 had been killed by this disease. In older orchards, in which no accurate check was made, a number of trees were killed by this organism.

PRUNUS CERASUS, CHERRY, SOUR. Coccomyces hiemalis (leaf spot) developed rapidly during June, but the following drought checked the epiphytotic, loss being less than in recent years. Dibotryon morbosum (black knot) was observed as severely damaging one small tree in a home garden in Washington County. Monilinia fructicola (brown rot) was of little importance in 1943.

VITIS SP., GRAPE. Cercospora viticola was found in abundance in one location in western Virginia. Guignardia bidwellii (black rot) was very destructive throughout the State.

SPECIAL CROPS

ARACHIS HYPOGAEA, PEANUT.

Mycosphaerella arachidicola was the cause of the leaf spot collected in August, while M. berkeleyi was the most abundant species on collections in the same areas in October. In the opinion of those familiar with the problem, infection and loss was somewhat less than in recent seasons. Sclerotium rolfsii (southern blight) killed few entire plants in most fields, the number being less than 5% in any field seen. However, in some fields, which at first glance showed little death of plants, many plants were found to have one or two dead stems.

In company with Dr. S. A. Wingard, 3 days were spent in examining peanuts at harvest time. Mr. E. T. Batten, Superintendent of the Holland

Station, estimated that approximately 30% of the peanuts of proper maturity in that section were rotted, the rot ranging from 5 to 50% in different fields. Accurate counts were difficult because of the tendency of the rotted nuts to be lost in digging. The incidence of rot was correlated with crop rotation, being more extensive where peanuts followed peanuts than in fields not recently planted to peanuts or to other susceptible crops. In general, rot was more severe on plants of which some stems had been killed than on plants that showed no wilt.

At the Holland Experiment Station adjacent plots of peanuts following peanuts and peanuts following soybeans were examined. Immediately after digging (mechanical) the pods from 4 consecutive plants in each plot were opened and the condition of the nuts recorded. While these counts are of limited extent, the plants examined appeared representative of the plots. The data are presented in Table 1.

Table 1. Effect of rotation on rot of peanuts.

	Peanuts following			
	Peanuts		Soybeans	
	Attached to vine	Loose* in soil	Attached to vine	Loose in soil
Pods very immature	8	-	10	3
Pods sl. immature, probably usable	15	2	29	2
Pods mature, nuts sound	5	1	36	1
Pods over-mature, nuts sound	1	14	7	1
Mature to over-mature, nuts rotted:				
Sclerotium rolfsii	13	14	17	8
shrivelled, prob. *Sc. rolfsii*	13	12	2	7
miscellaneous rots	4	1	3	1
Harvested crop:				
sound	21	(17) (38)	72	(4) (76)
rotted	30	(27) (57)	22	(16) (38)

* Pods lost in normal digging operations

The rot of peanut pods was due principally to *Sclerotium rolfsii*. Of the several samples collected from various fields, microscopical examination by Dr. Wingard revealed that a low percentage of the pods contained fruiting structures of *Thielavia*, *Penicillium*, *Rhizopus*, and other fungi.

GOSSYPIUM, COTTON. *Alternaria gossypina* (leaf spot) was very abundant. *Fusarium moniliforme* (boll rot) was present on less than 1% of the bolls in one field. *Xanthomonas malvacearum* (angular leaf spot) was abundant.

NICOTIANA TABACUM, TOBACCO

This section has been abbreviated from a report prepared for the writer by Dr. W. A. Jenkins of the Tobacco Experiment Station at Chatham.

Peronospora tabacina (downy mildew) caused individual plant bed losses ranging from negligible to 90%; average losses ranging between 25 and 40%.

The sustained epiphytotic contributed to the late planting of at least 1/3 of the tobacco acreage in Virginia and to severe losses later in the season (PDR 27:298, 1943).

Phytophthora parasitica var. nicotianae (black shank) was seen on several farms in Pittsylvania, Halifax, Charlotte, Franklin, and Mecklenburg Counties from which there had been no reports of the disease in previous seasons. In only a few instances did the infestations appear to have been of recent origin.

Pseudomonas solanacearum (Granville Wilt) continued to spread locally in both the bright and dark fire-cured belts. Losses ranged from a few plants to as high as 70% of the plants in some fields.

Rhizoctonia solani (sore shin) was general throughout the bright tobacco belt. In most cases the total loss was negligible. In Patrick County severe losses were reported locally.

Sclerotium rolfsii (southern blight) was seen in only a field or two in Pittsylvania County.

Thielaviopsis basicola (black root rot) was observed fairly generally throughout the area. Owing to the late season and the use of resistant varieties in the bright tobacco belt, the disease caused little noticeable damage except locally.

Heterodera marioni (rootknot) was present and appeared to be spreading slowly in certain sections of Pittsylvania, Halifax, and Dinwiddie Counties.

Brown root rot (cause undetermined) was found on 2 farms in Halifax County.

Mosaic (virus) was general throughout the tobacco area, field infections ranging from 10 to 90%.

Ring spot (virus) was scattered, though on the increase in the bright tobacco belt. Losses probably were insignificant.

"Ruffle leaf" (probably genetic anomaly) was found in a single field in Franklin County during the season. Essentially every plant in this field was affected and the crop was rendered unfit for harvest.

MISCELLANEOUS CROPS

IPOMOEA HEDERACEA Albugo ipomoeae-panduranae (white rust) was abundant in immediate proximity to sweetpotato fields.

IPOMOEA PURPUREA, WILD MORNING GLORY. Albugo ipomoeae-panduranae (white rust) was abundant in immediate proximity to sweetpotato fields. Coleosporium ipomoeae (rust) was observed frequently. Cercospora viridula (leaf spot) was collected in western Virginia.

PINUS STROBUS, WHITE PINE. Chlorotic dwarf (cause unknown) was diagnosed tentatively as the cause of chlorosis and dwarfing of a few transplanted white pines in gardens in Blacksburg.

Needle blight (probably nonparasitic) affected many white pines in Floyd and Montgomery Counties. Early in the season this injury was diagnosed by Dr. S. A. Wingard as being caused by the death of feeding roots due to excessively high soil moistures. A similar trouble is described in more detail in the summary for West Virginia.

PRUNUS SEROTINA, WILD BLACK CHERRY. Phyllosticta prunicola (leaf spot) was abundant in two locations in eastern Virginia. Tranzschelia pruni-spinosae (rust) was abundant at one location in eastern Virginia.

EMERGENCY PLANT DISEASE SURVEY IN WEST VIRGINIA IN 1943

Carlton F. Taylor

Work on the Emergency Plant Disease Prevention Project was started in West Virginia July 27, 1943. While many crops had been harvested at that time, the writer had been in a position to observe diseases in portions of the State during the early season. During the remainder of the season an attempt was made to visit each crop region at least once at a time suitable for examination of the most common crops grown.

Data on cereal crop diseases were obtained from Mr. William Watson, in charge of the Barberry Eradication program in West Virginia; the source of such data are indicated in the text. Members of the Department of Plant Pathology made available other data on crop loss.

Following are the observations on plant diseases in West Virginia in 1943:

VEGETABLES

BETA VULGARIS, BEET. Cercospora beticola (leaf spot) was prevalent throughout the State but appeared to cause little loss. Nematode (unidentified) was the probable cause of galls on a specimen submitted to the Experiment Station for diagnosis.

BETA VULGARIS var. CICLA, SWISS CHARD. Cercospora beticola (leaf spot) caused the discard of more than 50% of the leaves in many plantings.

BRASSICA OLERACEA var. CAPITATA, CABBAGE. Fusarium oxysporum f. conglutinans (yellows) was observed on few plants. The use of wilt-resistant varieties is general in West Virginia. Plasmodiophora brassicae (club root) was found in one garden in Morgantown.

BRASSICA RAPA, TURNIP. Phyllosticta tabifica (leaf spot) was abundant in gardens in two sections of the State.

CUCUMIS SATIVUS, CUCUMBER. Colletotrichum lagenarium (anthracnose) killed the vines in a greenhouse planting; this developed after a normal crop had been harvested, so probably caused little loss. Many garden plantings in Monongalia County were killed by this disease.

DAUCUS CAROTA, CARROT. Alternaria carotae (leaf blight) was widely distributed. A reduction in yield of 5% is estimated.

LYCOPERSICON ESCULENTUM, TOMATO. Alternaria solani (early blight) was general throughout West Virginia. It was estimated that 40% of all tomato foliage in the State was killed by this disease. Many fields were defoliated in early stages of production.

Cladosporium fulvum (leaf mold) was found in two locations in gardens with very poor air drainage. Where observed the percentage of infection was high. It is assumed that some loss in yield was incurred.

Fusarium oxysporum f. lycopersici (wilt) caused extensive loss in plantings of non-resistant varieties, mostly in novelty-type varieties.

Phytophthora infestans (late blight) was of major importance in the mountainous districts. In some plantings all of the leaves had been killed and 2/3 of the fruit had rotted by early September. In Pocahontas County

it was estimated that a crop loss of 25% was caused by late blight. It is estimated that the loss for the State was not more than 2%.

Phytophthora parasitica (buckeye rot) was much less abundant than late blight. In adjacent Victory gardens with unstaked plants of the same variety and age, heavily straw-mulched vines had no rotted fruits in September, while unmulched plants had 44% of the fruits rotted by this organism.

Septoria lycopersici (leaf spot) was found frequently but caused severe loss in few fields. Over the entire State it caused not more than 1/5 as much leaf destruction as did Alternaria.

Nematode (probably Heterodera marioni) was observed to be severely affecting all tomato plants in a garden in Logan.

Mosaic (virus) was rare in most plantings. In one planting of 1000 plants all plants were affected severely and production was negligible. In garden plantings the incidence of mosaic varied from 0 to 25%. In one greenhouse mosaic apparently was contracted from adjacent petunias, necessitating the discard of a lot of experimental plants. The loss for the State due to mosaic probably was not more than 1%.

Tip blight (virus) was present in the greenhouse where discovered in 1942, but in very much reduced amounts. A clean-up campaign was responsible for this reduction.

Blossom end rot (non-parasitic) caused severe losses in the drought-affected commercial areas in the eastern part of the State. Counts of affected fruits ranged as high as 62%, The loss for that section was estimated at from 15 to 20%. A state-wide loss of 10% was estimated.

Lightning killed all of the plants in a small area in one field.

PHASEOLUS LUNATUS, LIMA BEAN. Bacterial blights were observed in several plantings, but appeared to have caused little damage.

Phytophthora phaseoli (downy mildew) was present on approximately 15% of the pods in one semi-commercial garden in mid-September. Mosaic symptoms were present on 5% of the plants in a commercial field.

PHASEOLUS VULGARIS, BEAN. Colletotrichum lindemuthianum (anthracnose) was not found in most of the gardens examined. In a few gardens the loss approached 100%. In most cases it appeared that the source of inoculum lay in rows planted to home-grown seed.

Fusarium sp. (root rot) killed as high as 20% of the plants in several gardens in the vicinity of Morgantown. No observations were made on the prevalence of this disease throughout the State.

Pseudomonas medicaginis var. phaseolicola and Xanthomonas phaseoli (bacterial blights) rarely were observed to have caused appreciable loss and in most cases could be traced to the use of home-grown seed. In one large garden all of the leaves and 5% of the pods were infected on September 8.

Uromyces phaseoli var. typica (rust) was observed in several localities, but had caused appreciable defoliation in only one or two cases.

SOLANUM TUBEROSUM, POTATO. Actinomyces scabies (scab) appeared more prevalent than in past seasons. Several cases of very severe loss (more than 50% of the market value of the crop) were encountered. This appeared to be due in part to a brief dry period at the time of tuber formation in these fields and, in part, to injudicious application of lime.

Alternaria solani (early blight) was prevalent on early maturing varieties in the lower portions of the State. In the mountainous regions it was less damaging because, if the potatoes were not protected by sprays, late blight killed the foliage in advance of the early blight. A loss of 6% for the State was estimated.

Corynebacterium sepedonicum (ring rot) was observed in several lots of harvested tubers.

Erwinia carotovora (bacterial soft rot) was the probable cause of the loss of as many as 5% of the tubers in several fields. Usually this disease was correlated with excessive injury from the wheels of the potato spray machinery.

Pellicularia filamentosa (Corticium solani) (rhizoctonosis) was not studied in relation to sprout injury in the spring. Sclerotia were observed on the tubers in a few fields, 37% of the tubers affected being the most severe infestation noted. In this field 4% of the tubers were pitted, these pits resembling those typical of insect injuries followed by Rhizoctonia.

Phytophthora infestans (late blight) caused reductions in yield of more than 50% in unsprayed or poorly sprayed fields. Most of the loss was due to reduced tuber size due to foliage loss. Tuber rot was slight owing to to the very dry weather preceding and during the harvest period. The total loss in yield for the State was estimated at 17%. During early August at the height of the epiphytotic, unsprayed fields were observed to have progressed from one or two focal points of infection to destruction of 80% of the foliage in from 8 to 10 days.

Pythium sp. was suspected of being the cause of "leak" observed in many fields at harvest time. The maximum infection noted was not more than 2 or 3%, the loss for the State being negligible.

Spondylocladium atrovirens (silver scurf) was observed on the tubers from many fields. Infection was slight and it is believed that this disease caused no reduction in market value.

Bluestem (virus) was less severe than in 1940 and 1941. A loss of 3% was estimated.

Spindle tuber (virus) symptoms were observed in several lots of harvested tubers, in one lot approximately 10% being affected.

Virus diseases such as mosaic, leaf roll, and others were observed in many fields. During the season of this survey the plants had passed the optimum period for the diagnosis of such diseases.

Hopper burn (leaf hopper) caused heavy loss in production in the same areas affected by early blight. A loss of yield of 6% for the State was estimated.

CEREALS, GRASSES, AND FORAGE CROPS

AVENA SATIVA, OAT. Puccinia coronata (crown rust) caused an estimated loss in yield of 2% (Watson). Puccinia graminis var. avenae (stem rust) was estimated as causing a loss of 0.5%.

Ustilago avenae (loose smut). Data were taken by the writer on plots from 32 samples of oats taken from farmers' grain drills and planted at an experiment station. The smut counts showed a range of from 0 to 18%,

averaging 3.98%. Only one sample yielded a positive test for the presence of a seed treatment. It is believed that these data are representative of the State.

HORDEUM VULGARE, BARLEY. Gibberella zeae (scab) was reported as a 4% loss, approximately half as destructive as in 1942. Puccinia anomala (leaf rust) was reported as a loss of 1% (Watson). Puccinia graminis var. tritici (stem rust) was reported as a trace (Watson). Ustilago sp. (loose smut) was estimated to have caused a loss of 3%.

POA PRATENSIS, BLUE GRASS. Ustilago striaeformis (smut) on the basis of information made available by J. G. Leach and others, affected as high as 25% of the plants in some pastures.

SECALE CEREALE, RYE. Claviceps purpurea (ergot) was observed in a few fields.

SOJA MAX, SOYBEAN. Xanthomonas phaseoli var. sojense (bacterial pustule) was observed in most sections of the State, but in no case did it appear to be causing appreciable damage.

SORGHUM VULGARE, SORGHUM, CANE. Puccinia purpurea was found on the leaves in one planting.

TRITICUM AESTIVUM, WHEAT. Gibberella zeae (scab) was less severe than in 1942 but was estimated as causing a loss of about 4%. Puccinia graminis var. tritici (stem rust) was prevalent in the southeastern part of the State where the native barberry is abundant. The loss due to this disease in West Virginia in 1943 was estimated at between 10 and 15% (Watson). Puccinia rubigo-vera var. tritici (leaf rust) was estimated as causing a loss of approximately 1% (Watson). Ustilago tritici (loose smut) was estimated as causing a loss of 3%.

ZEA MAYS, FIELD CORN. Helminthosporium turcicum (leaf blight) was observed to be causing severe leaf injury in but 4 of all corn fields within view of the roads travelled in the course of this survey. This disease was very much less severe than in 1942. Ustilago maydis (U. zeae) (smut) was present in most of the fields, but usually affected a low percentage of the ears.

FRUIT

AMYGDALUS COMMUNIS, ALMOND. One tree in Brook County, the only almond tree observed, showed advanced symptoms of yellows (virus).

AMYGDALUS PERSICA, PEACH. Monilinia fructicola (Brown rot) caused minor loss, probably due to dry weather at harvest time. Virus yellows is widespread on non-commercial plantings, an estimated 20% of such trees being affected. In commercial orchards the loss was much less than 1% of the trees. Frost killing of the buds reduced the crop by at least 50%.

AMYGDALUS PERSICA var. NECTARINA (NECTARINE). One tree in Jefferson County showed symptoms of yellows (virus). This was the only nectarine tree seen.

MALUS SYLVESTRIS, APPLE. Armillaria mellea was considered responsible for the death of 4 of 245 dead trees in the 3- to 14-year age class. Erwinia amylovora (fire blight) was much less severe than in recent years.

Gloeodes pomigena (sooty blotch) was abundant on fruit from unsprayed orchards.

Glomerella cingulata (bitter rot) was rarely seen in the drought-affected eastern portion of the State. In the Ohio Valley one count of 60% infected fruit was obtained; many trees reached 20% infected fruit. These were isolated cases and the loss for the State as a whole was negligible.

Gymnosporangium juniperi-virginianae (cedar-apple rust) was more prevalent than during recent years. Leaf infections caused a considerable amount of premature defoliation in some orchards, in a few cases this condition being aggravated by spray injury initiated in the rust lesions. In one Rome Beauty orchard 20% of the fruit was reduced in grade from U.S. No. 1 to No. 1 Canner, a few with very deep lesions being graded as cider apples. Little fruit infection was seen in most orchards.

Helminthosporium papulosum (black pox) was found in unsprayed orchards.

Illosporium malifoliorum (leaf spot) was observed in abundance in an unsprayed orchard.

Leptothyrium pomi (fly speck) was abundant on fruit from unsprayed orchards.

Mycosphaerella pomi (fruit spot) was found rarely.

Phyllosticta solitaria (blotch) was rarely found in the dry eastern portion of the State. Where rainfall was more abundant it was found on susceptible varieties. Eighty per cent of the fruit were infected on one Gano tree in the Ohio Valley.

Physalospora obtusa caused very little loss in sprayed orchards.

Phytophthora cactorum (crown rot) was tentatively diagnosed as the cause of death of more than 1000 5- to 10-year-old trees. It was first called to the attention of Dr. A. B. Groves of the Winchester Research Laboratory by a grower who lost more than 500 trees from this disease.

Venturia inaequalis (scab) was much more prevalent than during recent seasons. The loss was more severe in the western than in the eastern portion of the State; many poorly sprayed orchards being defoliated by midsummer due to scab. The loss due to scab was estimated at 16.4% (12% yield and 4.4% quality).

Xylaria mali (black root rot) appeared to be more prevalent than during recent years. This was assumed to be an effect of drought, less loss of root system being tolerated than in normal years. It is probable that a tendency to visit orchards where tree loss had been reported in those cases where prior information was available provided an upward bias in the estimates of tree loss for the area.

Bitter pit (non-parasitic) was present in many orchards, occasionally causing severe loss. The loss for the State probably was lower than 1%.

Internal bark necrosis (non-parasitic) was found occasionally, but was of minor importance.

Frost injury on the night of May 1 reduced the crop by about 40% in the eastern part of the State and by approximately 80% in the remainder of the State.

PRUNUS spp., CHERRY, SOUR AND SWEET. Coccomyces hiemalis (leaf spot) was much less severe than in recent years in the dry eastern portion of the State. Here unsprayed orchards were only partially defoliated at the end of the season in contrast to recent years when unsprayed trees were defoliated in mid-August. Leaf spot was severe in other portions of the State. Monilinia fructicola (brown rot) was of minor importance in 1943.

RUBUS sp., RASPBERRY. Elsinoë veneta (anthracnose) was found on specimens submitted to the Experiment Station by a County Agricultural Agent. Mosaic (virus) was seen frequently but no data were collected on its prevalence.

VITIS sp., GRAPE. Guignardia bidwellii (black rot) probably caused the destruction of well over 50% of this fruit in 1943. Losses of 80% were common in unsprayed plantings. Plasmopora viticola (downy mildew) infected 100% of the leaves in many plantings and, in some cases, caused a 50% defoliation by late September. Yield loss was slight since most of the grapes in these plantings had been destroyed by black rot. Uncinula necator (powdery mildew) was present on many of the leaves in one vineyard.

TREES

PINUS STROBUS, WHITE PINE. Needle blight (probably non-parasitic). In June of 1942 the writer had occasion to examine a few hundred acres of white pine forest (natural stand) in which a die-back of needles was prevalent. The symptoms agreed closely with those later described by Spaulding and Hansbrough (Spaulding, Perley, and Hansbrough, J. R. The needle blight of eastern white pine. Mimeographed report issued by the Division of Forest Pathology, February, 1943. Two pages). Needle tips were a reddish-brown and the affected parts appeared to be dead. At that time it was suggested that this was a drought effect. With the advent of heavy rains new growth developed, these new needles remaining in excellent condition throughout 1943. The needles affected in 1942 dropped during the winter of 1942-43.

In 1943, during an excessively wet spring, similar foliar symptoms developed. In West Virginia affected pines were observed in most sections where the white pine occurs naturally. On most trees all needles were affected severely, on other trees the injury was confined to the leaf tips on portions of the tree. During the period from mid-July to late October no noticeable change occurred in the appearance of the affected trees. A similar injury in Virginia was noted by Dr. S. A. Wingard of the Virginia Agricultural Experiment Station and diagnosed as being caused by the destruction of rootlets in saturated soil moistures. Large numbers of pines were affected in eastern West Virginia. No data are available as yet on the survival of trees affected in 1943.

Chlorotic dwarf (cause unknown) was diagnosed by May and Swingle of the Division of Forest Pathology as the cause of stunting of white pines in two plantings in West Virginia.

QUERCUS ALBA, (WHITE OAK). Many mature white oak trees were killed by an unidentified trouble in southern West Virginia in 1943. Beyond the fact that the two-lined chestnut borer was present in the affected trees, no diagnostic data were obtained in a brief survey. Arrangements were made to revisit the area in 1944 in company with forest pathologists if the 'disease' reappears.

KENTUCKY PLANT DISEASE SURVEY, 1943

R. A. Hyre

The following is a summary of surveys made in September. Credit is due Dr. Valleau and his staff for assistance in identification of specimens.

VEGETABLE CROPS

IPOMOEA BATATAS, SWEETPOTATO

Twenty-two fields were examined carefully, centering around Graves County in western Kentucky and Jefferson County (Louisville) in north-central Kentucky. The fields varied from 1 to 5 acres in size with one 10-acre field included. The variety was largely Nancy Hall.

(Fusarium oxysporum f. batatas (F. batatatis and F. hyperoxysporum) stem rot, was virtually the only disease encountered. The loss varied from about 20% in lower western Kentucky to about 10% around Louisville. One field each at Lexington and Hopkinsville was free from stem rot while about 5% was present in one field each in McCracken, Todd, and Warren Counties. In 2 fields examined the Porto Rico variety had from 1/3 to 1/5 as much stem rot as Nancy Halls in the same fields. In 2 acres of Maryland Golden a trace of stem rot was found while adjacent Nancy Halls had 10%.

Endoconidiophora (Ceratostomella) fimbriata, black rot. Harvested potatoes were seen on only one farm in Jefferson County, and a trace of black rot was present there.

Mosaic (virus) was seen only in Todd County where 0.5% occurred in 1-1/2 acres.

LYCOPERSICON ESCULENTUM, TOMATO.

Eleven fields, averaging 3 to 4 acres each, were examined in the western half of the State. Severe drought conditions injured the crop.

Alternaria solani, early blight, owing to dry weather, was unimportant except in the single field examined in Warren County which was 50% defoliated.

Bacillus sp., soft rot was of little importance except in some cases where it followed and destroyed fruit already damaged by sun scald.

Fusarium bulbigenum f. lycopersici, wilt, was found in 3 of the 11 fields. 11% in 8 acres in Christian County, 35% in one acre in Graves County, and a trace in one field in Fayette County.

Colletotrichum phomoides, anthracnose, was found only in the 2 fields surveyed near Lexington (Fayette County) but caused little loss.

Sun scald. The tomato plants were not staked and with sparse foliage resulting from the drought sun scald of the fruit was almost universally present and severe. For example, the crop on 7 acres in Hancock County was almost a total loss from sun scald since the farmer could not afford to hire the tomatoes picked and haul them to the factory because of the low (half) price offered by the cannery.

CEREAL CROPS

SORGHUM VULGARE, SORGHUM

Cercospora sorghi (?). A purple leaf spot was very general in and around Harlan County.

ZEA MAYS, MAIZE (INDIAN CORN):

Twenty fields of corn were examined, covering the State. A severe drought in the western part of the State curtailed the survey.

Bacterium stewartii, bacterial wilt. The late infection, or bacterial leaf blight, was found in all fields examined, varying from 15 to 85% of the plants affected. The actual leaf area killed generally was estimated to be about 5 to 10%, occasionally reaching as much as 20 to 25% from all leaf diseases of which bacterial wilt was dominant in all areas except around Harlan and Letcher Counties in eastern Kentucky, and was frequently the sole leaf disease present in western Kentucky.

Cercospora zeae-maydis, leaf spot, was the dominat leaf disease in Harlan and Letcher Counties. This disease was not known to occur in Kentucky prior to this survey.

Fusarium moniliforme, ear rot, was frequently found following ear worm injury but the damage was slight. So few ear rots of any kind were found that the survey was discontinued.

Helminthosporium spp. were found most frequently in the eastern part of the state but were much less abundant than bacterial leaf blight.

Puccinia sorghi, rust, was recorded to the extent of 3% of plants affected in just one field.

Ustilago maydis (U. zeae), smut, was found to the extent of 3% of plants affected in just 2 fields.

Firing. A firing and drought injury of the leaves was so abundant in western Kentucky that it rendered the surveying of leaf diseases difficult.

FRUIT CROPS

AMYGDALUS PERSICA, PEACH

Three orchards were examined. The crop was almost eliminated by spring freezes.

Xanthomonas pruni, bacterial spot. In a McCracken County orchard bacterial leaf spot was general but not severe.

Spray injury. In a Livingston County orchard marginal spray injury of the Red Bird variety was severe.

MALUS SYLVESTRIS, APPLE

Fifteen orchards were visited. Many of them were along the Ohio River. A late spring freeze misled many growers as to their probable crop and, as a result, the spraying suffered.

Considerable information was obtained from Mr. W. D. Armstrong, Horticulturist, Western Kentucky Experiment Station, Princeton.

Gloeodes pomigena, sooty blotch. The presence of sooty blotch in 4 small and one large orchard indicated the omission of some sprays.

Glomerella cingulata, bitter rot, was present in 13 of the 15 orchards visited, being severe in 5 of them. In a Henderson County orchard a copper spray was not applied until bitter rot was already present and then it "kept on coming". This year diseases, particularly bitter rot, have been a major factor in fruit production of the Grimes Golden and Golden Delicious varieties. The variety King David has nearly been eliminated in Kentucky by bitter rot.

Gymnosporangium clavipes, quince rust, was causing concern and was generally present, but not in great abundance.

Leptothyrium pomi, fly speck, was found in the same 4 small orchards and one large orchard in which sooty blotch was found.

Phyllostica solitaria, blotch, was severe in one orchard each in Christian, Webster, and Henderson Counties and was present in Warren County. It was seen in a severe form on the variety Arkansas Black, was general on Grimes Golden, occurred on Kentucky Winesap, Mammoth Black Twig, and Stayman, and was present on Golden Delicious.

Phylospora obtusa, black rot, frog-eye. Black rot of the fruit was found from traces to considerable amounts in 9 of the 15 orchards. The frog-eye leaf spot caused considerable damage.

Venturia inaequalis, scab, was present in 13 of the 15 orchards surveyed, and was severe on some varieties in 5 of them. In general it was a bad scab year in Kentucky, but the disease was fairly well controlled in well-sprayed orchards. In other orchards scab and codling moth did not leave "enough apples for the second brood of codling moth".

Arsenical injury of the calyx end was the main problem in one Henderson County orchard.

SPECIAL CROPS

CANNABIS SATIVA, HEMP. Numerous fields observed from the car and a few entered, but no diseases were noted. The stands were very irregular.

NICOTIANA TABACUM, TOBACCO. A summary of diseases on this crop, furnished by W. D. Valleau and E. M. Johnson, follows:

TOBACCO DISEASES IN KENTUCKY, 1943

W. D. Valleau and E. M. Johnson[1]

The plant bed season of 1943 was unusually wet. The worst outbreak of wildfire [*Pseudomonas tabaci*] occurred in Central Kentucky in at least the past 25 years, emphasizing the importance of protracted wet weather in initiating an outbreak of this disease which has been comparatively rare in Central Kentucky. Wildfire was found in approximately 50% of untreated plant beds examined in Fayette and surrounding counties. The severe outbreak of wildfire and angular leafspot [*Pseudomonas angulata*] tested the value of the bordeaux treatment in preventing the diseases.

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[1] Kentucky Agricultural Experiment Station

Where applied early enough (before outbreak of the disease) bordeaux usually gave complete control throughout the plant bed season. An occasional instance was seen where a few plants in a small spot in a treated bed were infected, evidently in a spot missed in sprinkling. About 10% of the beds were treated early enough to prevent infection and much treating was done after infection appeared. Although plant bed infection was heavy, practically no wildfire or angular leafspot has been seen or reported to us this summer except in areas of fairly high rainfall several fields set from wildfire-infested beds appeared to be badly injured early in the season.

Blue mold [downy mildew, Peronospora tabacina] was reported twice in Central Kentucky (June 3 and 8) and from nowhere else in the State, although it is probable that there was a light infection in other places.

At setting time there were 2 hot periods. On June 4, 5, and 6 temperatures reached 92, 91 and 95° F; and on June 12, 13, 14, 15, and 16, maximums were 95, 96, 92, and 91° F. Stalks set June 4 were scalded, if the plants were shanky, and most leaves were killed. By June 7 the plants looked as though they might live although only the stalk and smallest leaves remained. Tobacco reset that day, when the maximum temperature was 88° F lived and grew rapidly; but rows not reset in the same plot continued to die for several days; and plants surviving in these rows grew slowly as compared with reset plants. In numerous fields throughout the State that were set during or within 2 or 3 days prior to the hot periods stands were poor and were not reset because plant died so gradually. Various reasons, such as drouth and wire worms, were given for poor stands, but there seems to be no doubt that the primary cause was the heat.

A drouth occurred over much of the State during July and August. Under these conditions mosaic [virus] spread very slowly and suckers after cutting showed unusually little mosaic. Kentucky 52 (NN) mosaic-resistant burley, where used by farmers who have been troubled with mosaic, has given perfect control. Kentucky 52 was of very high quality when cured.

Steak [virus] usually develops in burley tobacco in several counties northwest, north, and northeast of Fayette County in July. This year there was practically no streak during the drouth in July or August, but tobacco still standing the second week in September following rain developed an average of about 40% streak in 14 fields examined in Owen County. Fields along roadsides or waste places where sweetclover was growing showed heavy infection (up to 100%), while fields surrounded by closely cropped pastures or cultivated land were nearly free. It seems probable that infection occurred during July and August when second year sweetclover died and insects left it, but because of slow growth virus movement did not occur until after September rains when translocation of food materials and virus would be expected to be accelerated.

Black shank [Phytophthora parasitica var. nicotianae) was found in Woodford, Carroll, and Bath Counties and in a new location in Scott County higher up the Elkhorn Creek than previous outbreaks. In Bath County heavy infection was found for more than a mile along Slate Creek. Some was noticed in the creek bottom the previous year following a flood that covered some of the plantings with water soon after setting. The trouble was believed at that time to be drowning. In 1942 infection was carried to a

planting on a steep hillside about 300 yards up a draw from Slate Creek. This field was heavily infected again in 1943, and a planting on still higher ground in newly plowed land set immediately after the hillside plot was also heavily infected.

Fusarium wilt [Fusarium oxysporum f. nicotianae] seems to be on the increase; at least we are receiving many more reports of it than in the past. Kentucky 33 burley is being successfully used in infested areas; an occasional plant shows signs of infection but usually recovers. Wilt was reported in Simpson County to be causing serious loss in fields of One-Sucker dark tobacco.

Specimens of bacterial black stalk (Ky. Bul. 437) were received from Marion, Fayette, Bath, Mason and Lewis Counties.

Potash starvation was prevalent in Burley tobacco. In spite of almost ideal curing conditions following cutting, potash-starved tobacco appeared to be curing poorly. Upper leaves were harsh, lifeless and very dark brown.

Two cases of leaf spotting caused by phosphorus deficiency were observed, in one instance following a crop of vetch and rye turned under. In early August the older leaves of the small plants showed scattered necrotic spots. The leaves had a very low phosphorus content and the addition in the spring of superphosphate to a part of the field had a marked effect on growth.

TENNESSEE PLANT DISEASE SURVEY, 1943

R. A. Hyre

Following is a summary of surveys made in August, September, and October. Dr. C. D. Sherbakoff gave much assistance in diagnosing and verifying specimens.

Western Tennessee suffered a severe drought this summer. Dodder (Cuscuta sp.) was observed in many counties, often to a considerable extent. It was especially common on the annual lespedeza.

VEGETABLE DISEASES

CAPSICUM FRUTESCENS, PEPPER

Two 1-acre fields were observed in western Tennessee. Sclerotium rolfsii, southern blight, caused a 20% loss in one acre in Gibson County. Sun scald caused 25 to 30% loss in one acre in Shelby County.
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CUCUMIS SATIVUS, CUCUMBER

Colletotrichum lagenarium, anthracnose, was generally present in the only field observed in Madison County.

IPOMOEA BATATAS, SWEETPOTATO.

In addition to surveying sweetpotatoes in the field the records of the state inspectors on sweetpotatoes entered for certification were obtained from Professor G. M. Bentley, State Entomologist and Plant Pathologist, to whom the writer is indebted.

*CITRULLUS VULGARIS, WATERMELON. Only one field of any size was observed. Colletotrichum lagenarium, anthracnose caused loss estimated by the grower at 85% loss ($1,500.) in one field of Stone Mountain. Fusarium oxysporum f. niveum, wilt, is known to be important locally throughout the State.

Fusarium oxysporum f. batatas (F. batatatis and F. hyperoxysporum) stem rot. In 6 fields surveyed in the large sweetpotato area of western Tennessee the amount of stem rot varied from a trace to 50% in the Nancy Hall variety. The Porto Rico variety usually contained considerably less. Mr. Hazlewood, Superintendent of the Western Tennessee Agricultural Experiment Station, stated that stem rot will cause 20 to 25% loss year in and year out in western Tennessee. Considerably less was found in 11 fields examined in central and eastern Tennessee.

In the certification program 0.1% stem rot disqualifies. Because of stem rot sweetpotatoes of the Nancy Hall variety were not entered for certification in Gibson, Henry, and Weakley Counties in western Tennessee. Of 86 acres of Porto Ricos in 29 fields entered for certification 63% were condemned. In central Tennessee 6% of 40 acres of Porto Ricos and 26% of 137 acres of Nancy Halls in 63 fields were condemned. In eastern Tennessee none of 6 acres of Porto Ricos and 21% of 71 acres of Nancy Halls in 40 fields were condemned.

Heterodera marioni, root knot, in the form of 1 or 2 mm. holes on the surface with disfiguration extending into the roots, is becoming more important in eastern Tennessee and is seen on many of the roots marketed. By peeling, after cooking, and weighing 47 pounds of sweetpotatoes, with and without nematode injury, a loss of 11% was ascribed to nematode injury with 35 to 100 nematode scars per 1/2-pound root.

Endoconidiophora (Ceratostomella) fimbriata, black rot. In the first field inspection of 71 acres, mostly Nancy Halls, in eastern Tennessee 14 plants with black rot were found. A trace of black rot on a few early harvested sweetpotatoes was found in western Tennessee. A large grower there stated that black rot was no longer a problem with the commercial growers in that area.

Mosaic (virus). Only a trace (65 plants in 71 acres) of mosaic was found in eastern Tennessee.

LYCOPERSICON ESCULENTUM, TOMATO

Twenty-eight fields were surveyed in 19 counties representing all parts of the State.

Alternaria solani, early blight, in eastern Tennessee was very general and resulted in up to 50% defoliation of the plants by mid-harvest season. It was progressively less prevalent toward central Tennessee, and in western Tennessee it was virtually non-existent because of the drought.

Bacillus sp., soft rot, was universally present late in the harvest season but the loss was light.

Fusarium oxysporum f. lycopersici, wilt, was found in one county (Davidson) in central Tennessee and in 2 counties in western Tennessee. In Davidson County 43% wilt occurred in 8 acres in one field and 15% in 3 acres in another field. In these 2 fields alone the estimated loss to the farmers was $500. In a 3-acre field planted to tomatoes at least 2 years in succession, using the same untreated seed bed, 100% wilt was present. In western Tennessee wilt was associated with poor cultural practices.

Heterodera marioni, rootknot, was observed in 3 counties in eastern Tennessee. A 4-acre field in Sevier County was a total loss (some $500.) chiefly due to rootknot.

Phytophthora infestans, late blight of the foliage and fruit was found once, on a small patch of tomatoes at Pressmen's Home, Tennessee. The diagnosis was verified by Dr. C. D. Sherbakoff.

Phytophthora parasitica, buckeye rot, was serious in Jefferson County and was found in Knox and Warren Counties. In Jefferson County a cannery estimated 35% loss of the fruit on 500 acres ($55,000).

Mosaic (virus). Insignificant losses could be attributed to mosaic.

In the dry southwestern part of the state red spider nearly destroyed many small patches of tomatoes. It was not a problem elsewhere in the State.

Sun scald was serious in only a few fields visited.

PHASEOLUS VULGARIS, BEAN

The important bean area of Tennessee is in Johnson and Carter Counties. Nine fields (204 acres) of the main crop and 3 fields (25 acres) of the late crop were surveyed. Only small plots (except 10 acres near Nashville) were seen outside these counties.

Colletotrichum lindemuthianum, anthracnose, was severe in local areas in Johnson and Carter Counties. Fifty-three acres seen were abandoned because of it, 18 acres had 10 to 45% loss, and 100 acres were anthracnose-free. This was in the main crop. It was dry for the late crop and anthracnose was no problem.

Pellicularia filamentosa (Corticium vagum), pod rot, affected from 20 to 35% of the pods in 3 of 6 Victory gardens examined.

Fusarium solani f. phaseoli (F. martii phaseoli), dry root rot, was responsible for 40% loss in 2 fields totaling 22 acres, one at Nashville and one in Johnson County.

Heterodera marioni, rootknot, resulted in 50% loss in a Knox County Victory garden and apparently was the cause of 100% loss of 8 acres in Sevier County.

Isariopsis griseola, angular leaf spot, was frequently found in Johnson County but was of little economic importance.

Xanthomonas phaseoli, bacterial blight, affected most of the plants in a 1-acre field in Union County.

RHEUM RHAPONTICUM, RHUBARB.

Two small fields were observed. In Sevier County a 1-acre plot was marketed the first year because of Phytophthora sp., crown rot. Crown rot destroyed the second plot observed.

SOLANUM TUBEROSUM, POTATO.

Only about 10 acres of potatoes in the field were observed.

Phytophthora infestans, late blight, verified by Dr. C. D. Sherbakoff, was present over a 3-acre field at Pressmen's Home with 50% defoliation in the worst-affected areas. The potatoes were just beginning to bloom. The farm superintendent said it was the second time he had seen late blight there in some 25 years. According to the State Inspector no late blight was present on the Cumberland Plateau this year.

Dr. G. Steiner identified meadow nematode (Pratylenchus pratensis) as the cause of considerable loss to 5 acres of Chippewas on the Cumberland Plateau.

A trace of spindle tuber (virus) in Sequoias was seen at a grader at Crossville.

CEREAL DISEASES

SORGHUM VULGARE, SORGHUM. About 6 sorghum patches of 1 or 2 acres each were observed. Colletotrichum lineola, anthracnose, was severe at Pressmen's Home. A purple leaf spot was abundant at Pressmen's Home and was present in Union County in eastern Tennessee, and in Robertson County in central Tennessee.

ZEA MAYS, MAIZE, INDIAN CORN. Thirty-five fields of corn were surveyed, 19 in eastern Tennessee and 8 each in central and western Tennessee.

Bacterium stewartii, leaf blight phase, was found in all parts of Tennessee; from a few percent to 60% or more of the leaves were affected.

Cercospora sorghi, leaf spot. A slight amount was found in upper east Tennessee.

Cercospora zeae-maydis, leaf spot, identified by Dr. Charles Chupp, was found in 6 eastern and one central Tennessee Counties in a severe form in some of them. It was the dominant leaf spot in some areas. It had not been known to occur in the State previously.

Diplodia zeae, dry rot, was found in measurable amounts only at the Experiment Station at Knoxville where it varied from about 1 to 8.5% of the ears affected in 7 open-pollinated varieties.

Fusarium moniliforme, ear rot, was of no economic importance and was found following cornear worm injury.

Helminthosporium spp., were abundant in eastern Tennessee and to a less extent in central Tennessee. They were virtually absent in western Tennessee. At Crossville, H. turcicum was the dominant species; it was also found quite generally in eastern Tennessee. At Knoxville 3 different species or races were found.

Puccinia sorghi, rust, was found only occasionally.

Ustilago maydis (U. zeae), smut, was found in about 25% of the fields, especially in eastern Tennessee, varying from 1 to 6% of the ears affected.

Potassium deficiency was severe in southcentral Tennessee extending toward the western end of the State.

FRUIT DISEASES

AMYGDALUS PERSICA, PEACH

Five orchards were observed. The crop generally was frozen out this year.

Xanthomonas pruni, bacterial spot. A trace was found in a western Tennessee (Weakley County) orchard; it was of general occurrence in a middle Tennessee (Davidson County) orchard; and destroyed an estimated 7% of the foliage in an estern Tennessee (Bradley County) orchard.

Monilinia fructicola, brown rot. In one Bradley County orchard the grower estimated a 30% loss (50 bushels valued at $175.) in a 2% crop.

Dead trees. About 13% of the trees in a large orchard in Roane County were dead or dying. The cause is unknown, but is probably borers.

MALUS SYLVESTRIS, APPLE.

Seventeen orchards were visited representing the eastern, central, and western parts of the State. In addition, considerable information was obtained from Mr. A. N. Pratt, State Horticulturist. A serious killing frost during bloom greatly reduced yields and led to inadequate spraying of the remaining fruit.

Gloeodes pomigena, sooty blotch, occurring in eastern and central Tennessee indicated the omission or slighting of early sprays.

Glomerella cingulata, bitter rot, was found in 6 orchards in eastern and central Tennessee. It resulted in serious losses in 2 orchards.

Gymnosporangium clavipes, quince rust, diagnosed by Dr. Paul Miller, was found in eastern, central, and western Tennessee, usually in small amounts, but causing concern and resulting in as much as 10 to 15% loss on some varieties in a few orchards.

Gymnosporangium juniperi-virginianae, cedar rust, was found in an occasional orchard and was severe on the foliage of a large orchard in Johnson County.

Leptothyrium pomi, fly speck, generally accompanied sooty blotch but was of little economic importance.

Phyllostica solitaria, blotch, was found in only 2 orchards where the spraying was seriously neglected.

Physalospora obtusa, black rot, was universally present and was, perhaps, the most serious apple disease this year. Black rot of the fruit frequently followed codling moth injuries which were all too numerous, and frog-eye of the leaves was often serious.

Venturia inaequalis, scab, was found in the eastern part of the State and was a problem only when spraying was neglected. It was virtually absent in the dry western part of the State.

External cork, verified by Dr. W. D. Mills of Cornell University, was found in central Tennessee in varying but not great amounts.

DISEASES OF SPECIAL CROPS

ARACHIS HYPOGAEA, PEANUT. A number of fields were observed in western Tennessee. By the end of August the foliage was quite disease-free because of the drought. Sclerotium rolfsii, southern blight was of minor importance, 2% infection was found in one Madison County field, and a trace in another.

CANNABIS SATIVA, HEMP. In all but one of a number of fields observed, generally from the car, no diseases were noted. Sclerotium rolfsii, southern blight, was not observed except at the Experiment Station at Knoxville where about 10% of the plants in about one acre were affected late in July and the disease was spreading.

GOSSYPIUM HIRSUTUM, UPLAND COTTON.
Cotton was not closely observed. Fusarium oxysporum f. vasinfectum, wilt, in one 4- or 5-acre field in Madison County, destroyed nearly all the plants in a few spots. Due to potassium deficiency "red rust" was very general and quite severe in western Tennessee.

NICOTIANA TABACUM, TOBACCO. Very little time was given to tobacco and only a few isolated observations are given here.

Severe infection with Cercospora nicotianae, frog-eye, was observed in 4 acres in Maury County with the lower 3 to 5 leaves dead and perhaps a 20% loss. Specimens of Conopholis americana, squaw-root were sent to Dr. Sherbakoff from Giles County. The parasite was general over the field. The loss is unknown. Pseudomonas tabaci, wildfire, was severe in a 2-acre field in Green County and the farmer was cutting the tobacco green to save it.

One to 2% mosaic (virus) was noted in several fields in Cocke and Green Counties. Loss was negligible. An acre planting in Sevier County had 7% ringspot (virus) infection.

DISEASES OF SOYBEANS AND PEANUTS IN THE CAROLINAS IN 1943[1]

R. E. Atkinson

SOYBEAN. This report covers only the diseases found in the latter part of the growing season. Most of the fields were visited in September and October. At that time the early varieties were ripe and had shed their leaves.

Soybeans are grown principally in the Coastal Plains section of North and South Carolina. In 1942 in this eastern section of North Carolina 242,000 acres of soybeans were planted. In South Carolina cowpeas are much more popular as a hay crop and soybeans are grown to a limited extent

In the course of the survey varietal test plots at the Pee Dee Experiment Station, Edisto Experiment Station, and the Coker Seed Company test farms at Hartsville were visited in South Carolina. In North Carolina the Piedmont and the Willard Experiment Station varietal tests were observed. In addition, 126 fields of soybeans were inspected in North Carolina, totaling approximately 2520 acres. In South Carolina only 45 fields were inspected, totaling approximately 1,440 acres.

The severe drouth conditions along the eastern seaboard extended through North and South Carolina. It affected soybeans disastrously and yields of beans, never as high as in midwestern States, were at unprecedented lows. Many fields planted for seed were cut for hay.

Bacterial Pustule. The severe defoliation commonly observed was always accompanied by severe spotting of leaves by Xanthomonas phaseoli var. sojense, but was usually attributed to the drouth. Bacterial pustule was by far the most prevalent and most severe disease on soybeans in both States. It was present in all areas of the two States except for a few fields in the Piedmont region of South Carolina, where the Otootan variety

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[1] This report was compiled by the author with the cooperation of Dr. S. G. Lehman, Plant Pathologist, N. C. State College, and Dr. George M. Armstrong, Head, Botany and Bacteriology Department, Clemson College, S.C.; and the section on peanuts with the cooperation of Dr. Luther Shaw, Chairman of Plant Pathology, North Carolina State College, Raleigh, N. C

is still generally grown. The most popular varieties in South Carolina are the Volstate and the Arksoy, the latter being more severely infected than other varieties. In North Carolina fields of Mammoth Yellow, Tokyo, and Biloxi were commonly seen heavily infected with this bacterium.

In test plots the bacterial spot was notably severe on Seminole, Volstate, Tokyo, Biloxi and White Biloxi, Mammoth Yellow, Arksoy, Rose Non Pop, Charlee and Edsoy. It was less severe on Ogden and Clemson Non Shattering.

Bacterial Blight. It was difficult to differentiate with certainty between Bacterial pustule and Bacterial blight in the field. Perhaps in one of 10 fields a few spots would be found that were apparently caused by *Pseudomonas glycinea*. Nothing was observed in North and South Carolina in 1943 that would confirm the impression that bacterial blight is usually evident in every field and probably the most conspicuous and common disease of the soybean; at least that did not hold true in this region in 1943.

Mosaic. Mosaic was especially common on Seminole, Avoyelles, Biloxi and Yelredo in test plots. It was quite apparent that there are many different types of symptoms produced on the same variety that may be due to different viruses. In many instances leaf hopper injury rendered the mosaic symptoms difficult to see except on young leaves. The varietal expression of symptoms produced by both viruses and bacteria needs further study.

Mosaic was an important problem only in several fields of the Seminole variety grown near McBee, South Carolina. This grower had contracted with the government to grow 350 acres of Seminole, (an edible variety especially suited to the tropical conditions) which was to be used for planting. The drouth had reduced expected yields to around 5 bu. per acre. Leaf hoppers were abundant and the fields had been damaged by the feeding of this insect.

In his contracted fields 10% of the plants had mosaic, only 1% causing a severe stunting and rendering the plants practically sterile. This severe form is probably due to seed-borne or seedling infection.

In a field of 3 acres planted with selected seed fully 80% of the plants had mosaic. In the central part of the field half of the plants had the severe type of symptoms. This central area bordered on a field of corn with cowpeas planted between the rows. The cowpeas were uniformly infected with mosaic. According to the grower there was an abundance of leaf hoppers in this field also.

The presence of mosaic in these contracted fields would appear to limit the seed to use for human consumption. To use the seed for planting would be decidedly unwise.

Frogeye. Frogeye (*Cercospora sojina*) was found in trace amounts in all the test plots, but in 2 areas it was severe and causing damage. In southeastern North Carolina several fields of Biloxi and one field of Otootan were severely damaged by defoliation. Lesions on these varieties were observed on the leaves, stems, and pods. On Biloxi 25% and on Otootan 40% of the remaining leaf surface was affected.

In southwestern South Carolina on Otootan and another undetermined variety the leaf spot was 100% prevalent but damage was less extensive.

In test fields Cercospora was observed on Edsoy, Ogden, Biloxi, Otootan, Laredo, CharLee, and Missoy. Palmetto was very resistant or immune. The disease was more prevalent in late plantings.

Anthracnose. This disease was found in all test plots on the Rocusun variety, which had from 25 to 100% of the pods blasted by the fungus Glomerella glycines. Varieties growing in adjacent rows were not infected. At the Piedmont Station the fungus was also found on Ralsoy. At Monetta and Florence in South Carolina this disease was reported on Georgia 723.

Downy Mildew. Peronospora manshurica was found in trace amounts in all areas of the 2 States, although it was not important except as a possible source of seed infestation. Downy mildew was most severe in northeastern North Carolina where in late fields of Mammoth Yellow and Wood's Yellow the disease was 100% prevalent. Some plants were so thoroughly infected that the disease appeared to be systemic. No infection was found on the pods and the area was not again visited so the condition of the seed is not known.

Southern Blight. This disease was found throughout the 2 States. The response to the disease varied greatly. In a field of Arksoy 20% of the plants were killed by Sclerotium rolfsii. In another field of 30 acres 10% of the plants were killed and close by in a field of the same variety only 3% of the plants were killed. In a field of Biloxi 10% of the plants were killed just as they reached maturity.

In southwestern South Carolina the lesser corn borer heavily damaged fields of peanuts, cowpeas, and soybeans. Although S. rolfsii is not ordinarily thought of as a weak or secondary parasite, many plants almost girdled by the borer were attacked by S. rolfsii. It would be interesting to know the degree of interaction between the insect and the fungus. In one field the yield was reduced at least 20% by the fungus and the insect.

At Windsor, North Carolina a severe outbreak of southern blight in the test plots enabled the tentative classification of the varieties on the basis of their reaction to the disease. In several replications, Palmetto, Manloxi, Seminole, Biloxi, White Biloxi, and Yelredo were rated very susceptible, Mammoth Yellow, Macoupin, and Arksoy, susceptible, and Mamotan 6640, Clemson Non Shattering, and Wood's Yellow as resistant. In a nearby field of Arksoy there was 15% reduction in stand by S. rolfsii while a field of Wood's Yellow had less than 1% of the plants affected.

Miscellaneous Diseases. Charcoal rot caused by Sclerotium bataticola was found in trace amounts in many fields. In all test plots the variety Boone was 100% infected. Other early varieties were reported infected. Macrophomina phaseoli was collected on Seminole on stems 2 to 3 feet above the ground. The pycnidia and spores were identified by Dr. S. G. Lehman.

Fusarium wilt (Fusarium sp.) was especially severe in test plots on Yelredo. Wilt was also collected, and Fusarium isolated in South Carolina by Dr. Armstrong. Rootknot (Heterodera marioni) was found in many fields, but the damage caused was difficult to estimate.

Nematospora sp., the cause of yeast spot of soybean, was reported from many localities by Dr. S. G. Lehman (PDR 27(22):602. Nov. 1, 1943).

Pod and stem blight (Diaporthe sojae) and brown spot (Septoria glycines) were not seen this year.

Unidentified Diseases. A circular brownish spot, not quite so reddish brown and less angular than that caused by *Septoria glycines*, was found on Nanda, Wood's Yellow, Brunette, Tokyo, Wannamaker, Delsta, and Seminole at the Pee Dee Station. The first 3 varieties were heavily infected. At the Coker Seed Company plots 26 miles away the disease was not seen. In northeastern North Carolina some fields had only a trace, others were plastered with the spot. In one field severe spotting was associated with complete defoliation. In microscopic examination of leaves from different fields spores of *Helminthosporium* were found in considerable numbers. Isolations have thus far failed to yield cultures of *Helminthosporium*, the most common fungus isolated being *Alternaria tenuis*.

At the Piedmont Experiment Station a white stem spot was found on Clemson Non Shattering, Volstate, Tennessee Non Pop, Wood's Yellow, and Mammoth Yellow. No fungus could be found fruiting on or near these spots, and there was no evidence of insect punctures or eggs present. The color of the spot was due to the dead bleached epidermis which was tautly stretched over a sunken canker-like cavity. The white epidermis was often split or cracked. Isolations from these spots have failed to yield any certain fungi consistently.

PEANUTS. Peanuts are grown in 3 areas of the Carolinas. In the oldest area, in northeastern North Carolina where peanuts are grown most intensively, over 200,000 acres were planted in 1942. The oldest peanut-growing area in South Carolina extends along the state line across from Augusta, Georgia, toward Charleston, South Carlonia. In this area, 36,000 acres of peanuts were planted last year. The newest is a more or less continuous area in the 2 States, and coincides with the border bright leaf tobacco belt. In the new area over 20,000 acres were planted to peanuts in South Carolina and 30,000 in North Carolina.

The estimated loss from peanut leafspot has varied in past years from 1 to 2% in South Carolina to 20 to 30% in North Carolina, Virginia, and Georgia. The reason for this discrepancy was one of the purposes of the peanut disease survey. Another object was to ascertain if the leafspot was severe enough in the new areas to make a blanket recommendation that all growers dust peanuts.

Leafspot. The leafspot caused by *Cercospora* spp. is universally present. It was found in every field examined and undoubtedly occurs before harvest in all plantings. The prevalence, however, varied from a trace to 100%, and the severity from 0 to 50%. In some fields only a tuft of heavily spotted leaves remained on the stems at harvest time. In general, the disease was less severe this season than for many years. The decreased severity was probably due to the severe drought of late summer and early fall which also decreased yields in all areas.

Leafspot is closely associated with maturity and does not become severe until about two weeks before harvest. Thus, in fields side by side the same variety will vary greatly in the amount of leafspot, depending on the date of planting. This was particularly conspicuous in a field in which adjacent rows were planted at different times by the same planter, and with the same seed. The rows planted early had severe leafspot with 25% defoliation. The part of the field planted later had only a scattering of spots on the lower leaves and no defoliation.

There was less leafspot in the new than in the older areas, in general, but many fields in the new area had leafspot as severe as in the older areas. The low infection in the newer area may have been due to the poor stands, which were very common in the fields in this area. The poor stands have been attributed, after a careful survey by W. C. Nettles, Extension Entomologist at Clemson, to clogging or some other mechanical failure of the planter. Poor stands are rare in the old peanut-growing area in North Carolina.

The average defoliation was 50% in the old peanut-growing areas of North and South Carolina, respectively, and 30% in the new area. This probably means that the loss was from 10 to 20% in the old areas and from 5 to 10% in the new area.

It would seem therefore, that if a farmer has a good stand, dusting for the control of leafspot should be recommended in all areas.

Southern Blight. Dead plants or branches killed by *Sclerotium rolfsii* varied from 0 to 10%. It seemed to be as common in the new area as in the older areas. No relation between the previous crop and the prevalence of the fungus was observed. Perhaps if the prevalence of susceptible weed hosts in the previous crop were known, a relationship might be established. A plant may be completely killed by *S. rolfsii* but more often only a few dead branches mark the attack of the fungus. Dead and partially dead plants have been found to total as high as 10% of the plants. Many affected plants were apparently vigorous and healthy, the only sign of disease being the loose strands of the fungus growing among the fallen leaves at the crown of the plant. That these plants are severely damaged cannot be doubted for often when they are pulled and shaken only a few nuts remain attached. The pegs (gynophores) were rotted through by the fungus at soil level. Some of the nuts left in the soil were sound and undamaged; usually about half of them were rotted. Plants adjacent in the row to plants killed by *S. rolfsii* may or may not be affected.

Nut Rot. Another and apparently unrelated source of great loss to the farmer is the rot of peanuts in the soil. This has not been adequately surveyed but on plants dug at random in fields sometimes half of the nuts on a plant were rotted. There are apparently many insects that damage nuts in the soil but most of the rotted nuts were free from any obvious insect injury. This nut rot was not associated particularly with injury to tops by *Sclerotium rolfsii* but the possibility that this fungus by damaging the pegs, predisposes the nuts to rot should be investigated.

Shortly after these peanut rots were reported (September 18) rotted peanuts were cultured. Most rotted nuts yielded the common molds as *Penicillium*, *Trichoderma*, and *Rhizopus*. The fact that these organisms are non-parasitic stressed the possibility stated above, that damage to the pegs by *S. rolfsii* might predispose the nuts to rot.

About the middle of October when peanut harvest was in progress the writer returned to Raleigh, North Carolina. By this time alarmed reports were coming in from farmers in the old peanut area who were finding a high percentage of rotten peanuts. The expected 2/3 of a crop had dwindled in many cases so greatly that fields were not worth stacking and picking. Although great reductions in yield were undoubtedly due to a poor growing season which prevented setting of nuts except at the crown of the plant, a reduction of at least 50% in several counties was due to the rotting of

nuts in the ground and to the severence of the peg by S. rolfsii causing the nuts to drop off the vine. The nut rot was not severe in the old peanut growing area of South Carolina. The condition of the nuts after picking was not observed in the new area.

Miscellaneous Diseases. Bacterial wilt (Pseudomonas solanacearum) was reported from Northampton County and nematode injury (Heterodera marioni) was found in a field of the Virginia Bunch variety in Bertie County, North Carolina.

Leaf hopper "burn" was followed by various fungi, mostly species of Alternaria, which caused the tips of the injured leaflets to turn black and die.

SUMMARY OF PLANT DISEASE SURVEYS IN GEORGIA, 1943

G. M. Stone

VEGETABLE CROPS

ABELMOSCHUS ESCULENTUS, OKRA. A high percentage of the plants were wilted by Fusarium wilt (F. oxysporum f. vasinfectum) in a field in the Augusta area, and the disease was also found in gardens in this area, in north Georgia, and the Griffin area. Rootknot (Heterodera marioni) was prevalent in practically all gardens examined.

BRASSICA OLERACEA var. BOTRYTIS, CAULIFLOWER. Bacterial leaf spot (Pseudomonas maculicola) was general throughout 16 acres on the crop just beginning to head near Darien, but caused little damage. Nearly 100% infection by black rot (Xanthomonas campestris), with about 15% of the plants dead at the time of observation, occurred in 16 acres at Woodbine.

BRASSICA OLERACEA var. CAPITATA, CABBAGE. Most fields examined in the mountain section of north Georgia had been cut over at least one time. In these fields the remaining plants were usually severely infected by black leaf spot (Alternaria circinans). Worm damage was heavy and an undetermined soft rot followed the worm injury in many heads.

CAPSICUM FRUTESCENS, PIMENTO PEPPER. The following diseases were observed in the commercial area at Griffin. Only a few pods were found affected by anthracnose (Glomerella cingulata). Bacterial spot (Xanthomonas vesicatoria) was found in all fields examined, infection varying from general but light infections in some fields to severe infections in others. Plants in a few fields had been heavily defoliated. Little damage to the fruit resulted. A limited amount of blossom-end rot (physiogenic) was found, but more occurred than of anthracnose or ripe rot. Cercospora leaf spot (C. capsici) was general in all fields examined and causing heavy defoliation with killing back of the tender branches in several fields. Mosaic (virus) was general in all fields examined; usually a high percentage of the plants were infected. Ripe rot (Vermicularia capsici), which is most destructive in wet seasons, was found this year in only one crop delivered to the canner in Griffin. Rootknot (Heterodera marioni) was general in many fields examined and was severe in 3 fields. About 10%, on the average for the fields examined, of the plants were killed by

southern blight (Sclerotium rolfsii).

It was estimated that at least 25% of the entire Georgia crop was lost due to disease.

IPOMOEA BATATAS, SWEETPOTATO. Black rot (Endoconidiophora (Ceratostomella fimbriata) was general; an occasional crop with heavy losses was observed. Leaf spot (Phyllosticta batatas) was general but infection was light with no apparent damage. Stem rot (Fusarium oxysporum f. batatas) occurred generally over the State, but no more than 1% of the plants were affected except in an occasional field.

LYCOPERSICON ESCULENTUM, TOMATO. Several small fields (1/2 to 1 acre) in north Georgia were observed to be severely damaged by early blight (Alternaria solani). The leaves and tender branches were killed and a high percentage of the fruit was rotted. Blossom-end rot (physiogenic) was also prevalent and rootknot (Heterodera marioni) was moderately severe in the same fields. In a 3-acre field in Augusta, southern blight (Sclerotium rolfsii) was the principal cause of the loss of 50 to 60% of the stand, while 10 to 15% of the remaining plants were wilted by Fusarium wilt (F. oxysporum f. lycopersici).

PHASEOLUS VULGARIS, BUNCH BEANS. The late crop was examined in the mountain section of north Georgia. Anthracnose (Colletotrichum lindemuthianum) caused severe damage in 2 fields planted with seed of unknown origin. Bacterial blight (Xanthomonas phaseoli) occurred in scattered infections on stems and pods in one field. Mosaic (virus) was general in most fields. In several fields as many as 35% of the plants were diseased. Powdery mildew (Erysiphe polygoni) was general in all fields; in some all above-ground parts were affected and damage was severe. Scattered infection of Rhizoctonia stem and pod rot (R. solani) was observed on stems and pods in one field. Rootknot (Heterodera marioni) was found in many creek-bottom fields. It was causing severe damage in 2 fields. Rust (Uromyces phaseoli var. typica) (U. appendiculatus) was found in all fields examined. Severe infections occurred in many fields, with the pods "rusted."

DISEASES OF SPECIAL CROPS

ARACHIS HYPOGAEA, PEANUT. Cercospora leaf spot (C. personata and C. arachidicola; no effort was made to distinguish between the 2 species) was found generally over the entire State. It was decidedly more severe in the old peanut-growing area in south Georgia. Defoliation was heavy in many fields of Spanish peanuts; apparently it was less severe on the runner types. Damage in the old belt amounted to at least 10%.

Phyllosticta leaf spot (apparently P. phaseolina) was reported by Naomi C. Woodruff of the Georgia Experiment Station. It was found scattered in several fields where it caused little damage.

Southern blight (Sclerotium rolfsii) was almost as widespread as the Cercospora leaf spot. It caused greatest damage in the old belt where a high percentage of the plants were infected. Losses were extremely heavy in some sections, especially where harvest was delayed. Damage was greater than was reported earlier.

GOSSYPIUM spp., COTTON. Angular leaf spot (Xanthomonas malvacearum) was general in all fields but infection was light. Anthracnose (Glomerella gossypii) occurred on scattered bolls in several fields. In one field from 5 to 10% of the plants were wilted by Fusarium wilt (F. oxysporum f. vasinfectum); 2 fields were observed with severely wilted "spots". Scattered bolls in several fields examined were affected by Fusarium boll rot (Fusarium spp.). Severe infestation by root-knot (Heterodera marioni) was observed in a field in the Griffin area.

SACCHARUM OFFICINARUM, SUGAR CANE. Red rot (Colletotrichum falcatum) is reported to have been prevalent in banks in 1943, but losses were moderate. Mosaic (virus) was general on susceptible varieties. Losses were heavy in many patches.

NICOTIANA TABACUM, TOBACCO. Except for a few isolated cases of fairly high percentages, not more than 1% of the plants were infected by bacterial wilt (Pseudomonas solanacearum). Downy mildew (Peronospora tabacina) was epidemic in Georgia in the spring of 1943. About 80% of the plants in beds were killed. However, sufficient plants survived to set the crop. (From oral report by J. G. Gaines, Coastal Plain Experiment Station, Tifton).

MISCELLANEOUS HOSTS

CARYA ILLINOENSIS, PECAN. Early infections by scab (Cladosporium effusum) were heavy on susceptible unsprayed varieties over the entire southeastern belt pecan area. Losses for the entire season on unsprayed susceptible trees ranged from 25 to 75%. Brown leaf spot (Cercospora effusa) and downy spot (Mycosphaerella caryigena) were prevalent under the same conditions as scab. Rosette (zinc deficiency) was of minor importance in 1943 (Information furnished by John R. Cole, Pecan Field Laboratory, Albany).

VIGNA SINENSIS, COWPEA. Bacterial leaf spot (Pseudomonas syringae) (Bacterium vignae) was found scattered in several fields. Cercospora leaf spot (C. cruenta) was general in all fields examined but caused little damage. Five to 10% of the plants in one field were wilted by Fusarium wilt (F. oxysporum f. tracheiphilum) (F. vasinfectum var. tracheiphilum). Leaf spot (Amerosporium oeconomicum) was found in all fields examined but was very scattered in distribution and apparently caused no damage. Powdery mildew (Erysiphe polygoni) caused general and severe damage in many fields where plants were defoliated and tender branches killed back.

ZEA MAYS, CORN. Ear rot (Fusarium moniliforme) was severe on several varieties in the University variety test at Athens, and was prevalent in fields examined in south Georgia. Smut (Ustilago maydis) (U. zeae) was found scattered in all fields examined.

SUMMARY OF OBSERVATIONS ON PLANT DISEASES IN FLORIDA DURING THE EMERGENCY PLANT DISEASE PREVENTION PROJECT SURVEYS JULY 25 TO DECEMBER 31, 1943.

Arthur S. Rhoads

VEGETABLE CROPS

Weather conditions during late September and the first half of October were generally unfavorable for farm operations in the truck crop sections of Florida. Heavy rainfall greatly delayed operations, with extensive losses to seedbeds and early plantings in some sections. Later in the season lack of soil moisture retarded crop production in some sections without subirrigation. General shortage and high cost of labor, particularly of experienced workers, proved to be a great handicap to growers and in many cases portions of crops had to be sacrificed where there was little likelihood of their proving profitable with the excessive labor cost. Damage from cold weather caused extensive losses to many of the more tender crops in different sections of north central and central Florida.

BRASSICA OLERACEA var. BOTRYTIS, CAULIFLOWER. Xanthomonas campestris, black rot, was found to be serious in one 5-acre planting at Sanford, where the disease apparently had been attacking plants since they were fairly young and was causing wilting and dying of plants large enough to begin forming heads. The plant loss was estimated to be 30% and the disease appeared to be spreading rapidly.

BRASSICA OLERACEA var. CAPITATA, CABBAGE. Peronospora parasitica, downy mildew, was found to be of widespread occurrence in practically all the cabbage-growing areas visited in north central and central Florida, frequently resulting in heavy loss of plants in the seedbeds where growers were not in position to dust or spray at frequent intervals or failed to do a timely or thorough job. Evidence of this disease was noted on the older leaves of heading plants in a number of localities but in no case did it appear to cause any appreciable injury to the crop.

Rhizoctonia root rot was observed to cause losses in parts of new plantings at a few places but they were mostly small and local in extent. A more serious case of this trouble was observed in a much older 5-acre planting at Winter Garden, where the plant loss was estimated at 5%.

One grower at Zellwood, who had 50 acres of cabbage seedbed sown in drills, reported that this planting was lost by cold weather, the temperatures going down to 25, 26, 27 and 30° F. on 4 consecutive mornings. This was an especially serious loss as he claimed to have had sale contracts for 2 million plants and the cold killed them about a week before they would have been ready for marketing.

CAPSICUM FRUTESCENS, PEPPERS. Plantings of peppers were greatly retarded by excessively wet soil conditions and some acreage at Winter Garden and Minorville was killed, while in other cases the plants recovered but tended to remain abnormally small.

Cercospora capsici, leaf spot, was of widespread occurrence in one of the few fields seen at Sanford, where it caused considerable defoliation. In the Winter Garden area, however, where the new blight-resistant Worldbeater variety was grown exclusively, the amount of leaf spot was negligible.

Rhizoctonia solani apparently was responsible for occasional dying of plants in one 16-acre field at Winter Garden. Miscellaneous fruit rots occurred in most fields visited, especially where fruit rested on the ground, but losses from this cause were relatively small and partly aided by worms.

Pepper plantings examined in the northern part of the State were remarkably free from diseases and particularly mosaic, which was later observed to occur very extensively in some plantings in the vicinity of Dania on the lower East Coast.

CICHORIUM ENDIVIA var., ESCAROLE. *Alternaria cichorii*, leaf spot, was observed in one local area in one large field being cut at Sanford, necessitating heavy trimming to eliminate the unsightly-appearing outer leaves. This disease also was noted occurring quite generally in a 2-acre planting at Minorville. It is rarely troublesome during the cooler portion of the year and during that season fields are planted solidly, with no space left to permit driving through with spray machines.

CUCUMIS SATIVUS, CUCUMBERS. *Pseudoperonospora cubensis*, downy mildew, was the only disease that proved to be troublesome in plantings in the Wauchula section and those found at a few other points. The mildew was being held under control fairly well by dusting but in some cases the dusting did not appear to have been done with particular thoroughness of coverage so far as the lower sides of the leaves were concerned. One planting of 1 1/2-acres was so severely attacked by mildew as to probably reduce the yield by 50%, especially as picking had not yet begun. Cold winds caused considerable leaf injury in two 10-acre plantings at Clearwater and Winter Garden, respectively. Rootknot (*Heterodera marioni*) was rather prevalent in one 10-acre planting at Winter Garden.

CUCURBITA PEPO var. CONDENSA, SQUASH. Little in the way of diseases was observed in scattered plants of squash in Alachua and Marion Counties, most of which were small. *Pseudoperonospora cubensis*, downy mildew, was observed in some plantings but had not become sufficiently severe to result in any particular crop curtailment. A trace of blossom blight(*Choanephora cucurbitarum*) was observed in a few plantings and cucumber mosaic (virus) was noted on a few fruits in one planting. The plantings in these 2 northern counties were all killed prematurely by early frost.

DAUCUS CAROTA, CARROTS. Poor stands in young plantings on muck soil at Zellwood were attributed partly to dryness and coarseness of the surface soil in portions of the fields and to cold injury while the plants were still very young. No diseases were observed in any of the plantings examined.

IPOMOEA BATATA, SWEETPOTATO. Plantings of sweetpotatoes examined at various points in north central and western Florida appeared quite free from diseases so far as the vines were concerned. The only diseases observed were white rust (*Albugo ipomoeae-panduranae*) and leaf blight (*Phyllosticta batatas*) and neither were sufficiently severe to be of any particular consequence.

LYCOPERSICON ESCULENTUM, TOMATOES. *Alternaria solani*, early blight, was found to have caused considerable infection of leaves of plants in one local area of an unusually fine 30-acre planting on prairie land west of Rockledge, which was nearly ready for picking. However, this disease was

kept under control by spraying and a very profitable crop made. The success of this planting was joepardized by heavy rainfall earlier in the season but an additional pump was secured and installed in time to save all but about an acre in a depressed area that could not be drained so effectively.

PHASEOLUS VULGARIS, SNAP BEANS. Only a few small plantings were observed and these mostly after most of the crop had been picked. Most of these showed areas where the plants were more or less yellowed and occasionally somewhat stunted from infestation by jassids.

PISUM SATIVUM, PEAS. Rhizoctonia root rot apparently was responsible for dying and loss of from 35 to 40% of the plants in a 1 1/2-acre planting at Wauchula. Other small plantings suffered losses of varying extent from cold.

SOLANUM MELONGENA, EGGPLANTS. Phomopsis vexans, blight and tip-over, was the most serious disease found on this crop, presenting a serious problem for growers in Alachua and Marion Counties southward to central Florida. It commonly attacks plants in all stages from recent transplants to those approaching maturity. The principal injury resulted from the basal girdling of the plants, though lesions resulting in less serious injury commonly developed at other points on the stems. Rotting of the fruit was more or less common in most fields and other losses were reported in transit. No appreciable leaf spotting was apparent. Plant losses usually ranged from 10 to 25% in most fields examined and in a few cases ran up as high as 75%.

Pseudomonas (Bacterium) solanacearum, bacterial wilt, was observed to have taken a heavy toll of plants in one 10-acre field at Martin, where Phomopsis blight also was particularly widespread and many plants were unusually severely infected by rootknot (Heterodera marioni). This planting was said to have been a total loss.

Heterodera marioni, rootknot, was found infecting plants in a few fields but the one just mentioned was the only one in which they were especially severe.

Early frost killed all the fall eggplant plantings in Alachua and Marion Counties before their full productiveness was over.

CEREALS, GRASSES, AND FORAGE CROPS

CASSIA TORA, COFFEEWEED. Erysiphe polygoni, powdery mildew, was of widespread occurrence on plants at Ocala and Belleview. Rhizoctonia solani apparently was responsible for the wilting and dying of patches of seedlings in a cover crop plot at Quincy where coffeeweed was grown in rotation with tobacco. Heterodera marioni, rootknot, was found infecting roots of old plants severely in another cover crop plot.

CROTALARIA. Oidium erysiphoides var. crotalariae, powdery mildew, occurred abundantly on plants of C. retusa at Lake Alfred. Erysiphe polygoni powdery mildew, was widespread on leaves of C. spectabilis, showy Crotalaria, at Melrose, Devil's Millhopper near Gainesville, and Minorville.

CYNODON DACTYLON, BERMUDA GRASS. An undescribed species of Helminthosporium was associated with an extensive browning and dying of leaves in a test plot at the North Florida Experiment Station at Quincy.

DESMODIUM TORTUOSUM, BEGGARWEED. Oidium sp., apparently the conidial stage of Microsphaerea diffusa, caused extensive mildewing of plants growing as a cover crop in a citrus grove at DeLand and as an escape at Gainesville. No perithecia developed, however, even by the time the leaves were killed by cold.

LUPINUS CUMULICOLA. Cercospora longispora was observed causing large, conspicuous sooty spots on the leaves, with considerable defoliation, at De Soto City.

ORYZA SATIVA, RICE (upland). A Helminthosporium-like eye-spot was of general occurrence in a field examined at Perry. What appeared to be the same disease was of widespread occurrence on spreading witch-grass or fall Panicum (P. dichotomiflorum) that was growing abundantly adjoining the rice field and occurring scattered throughout it. Unfortunately, the fungus was not fruiting on material collected on either host.

PANICUM. An unidentified species of Ovularia was found causing dark linear streaks on leaves of plants of P. haemitomum, maidencane, between Largo and Seminole. (See also under rice).

PASPALUM URVILLEI, VASEY GRASS. Puccinia levis, rust, was collected on this grass at Island Grove and Sanford.

PENNISETUM PURPUREUM, NAPIER GRASS. Helminthosporium ocellum, eye-spot, was of very general occurrence on susceptible varieties at the Experiment Station but occurred sparingly or not at all in test plots of selections for resistance to this disease.

PUERARIA THUNBERGIANA, KUDZU. Pseudomonas medicaginis var. phaseolicola, bacterial leaf spot, was prevalent in plantings at Quincy but the spots were small and the disease not sufficiently severe to result in much defoliation.

SOJA MAX, SOYBEANS. Frog-eye disease (Cercospora sojina) (C. daizu) and bacterial pustule (Xanthomonas phaseoli var. sojense) were responsible for defoliation in variety test plots of the Experiment Station at both Gainesville and Quincy. Anthracnose (Colletotrichum glycines) commonly attacked the pods in both these localities. The prevalence of this disease, however, was not so important as it might seem since the pods usually failed to develop any appreciable amount of seed anyway.

The consistent failure to secure seed production appears to constitute the greatest drawback to soybean culture in Florida. The pods commonly fail to fill out properly and shrivel and shed prematurely. This trouble was apparent at Gainesville, Quincy and at other points in western Florida.

SORGHUM HALEPENSE, JOHNSON GRASS. Cercospora sorghi, leaf spot, attacked plants severely at Quincy. Colletotrichum lineola, anthracnose, also occurred to a slight extent on the same plants. Puccinia purpurea, rust, was prevalent on plants in the same locality.

SORGHUM VULGARE, SORGHUM. Ascochyta sorghi was found occurring sporadically on plantings of the Texas Seeded Ribbon variety at both Quincy and near Perry. Leaf spot (Cercospora sorghi) was found to be of frequent occurrence in some plantings, resulting in considerable premature dying of leaves. Anthracnose (Colletotrichum lineola) was of common and widespread occurrence in some plantings, also causing considerable premature dying of the leaves. Zonate spot (Gloeocercospora sorghi) was of fairly common occurrence in plantings of the Texas Seeded Ribbon variety at both Quincy

and near Perry, causing extensive blotching and dying of leaves. Rust (Puccinia sorghi) was found in but one of several plantings examined in western Florida, infection being noted on 25% of the plants in a portion of a field that still remained unstripped. Head molds due to Fusarium and other saprophytic fungi that commonly attack the inflorescences during the warm, humid rainy season of late summer resulted in greatly curtailed seed formation in some varieties in test plots of the Experiment Station at Gainesville.

STIZOLOBIUM DEERINGIANUM, VELVET BEANS. Leaf spot (Cercospora stizolobiae) was of widespread occurrence and an important factor in defoliation in all plantings examined, but the velvet bean caterpillar (Anticarsia gemmatilis) was by far the greatest factor in defoliation.

Potash deficiency appears to have become a limiting factor in making crops of velvet beans of late years in sections of western Florida where fertilizer is not used. Test plots of the North Florida Experiment Station at Monticello showed a marked response of plants to applications of dolomitic limestone, potash, and phosphoric acid. Potash deficiency appears to be the main limiting factor, however. Plants with no fertilizer consistently made a very weak growth, with scanty seed production. The leaves of such plants became distinctly chlorotic and the margins fired and died, and the plants became defoliated early.

VIGNA SINENSIS, COWPEAS. Leaf spots due to Amerosporium oeconomicum and Cercospora dolichi resulted in considerable defoliation in plantings at Quincy. Rhizoctonia root rot apparently was the cause of wilting and dying of seedlings in a cover crop plot at Quincy, where cowpeas were rotated with tobacco. Rootknot (Heterodera marioni) also was observed as a cause of unthriftiness of plants in another field at Quincy.

ZEA MAYS, CORN (field). Puccinia sorghi, rust, caused widespread and heavy leaf infection in the case of late plantings observed at Quincy and Jay. This disease is said to attack late plantings in western Florida rather severely as a rule.

FRUIT AND NUT CROPS

ALEURITES FORDII, TUNGOIL. Clitocybe tabescens. Clitocybe root rot, was observed to be of widespread occurrence and highly destructive to trees in commercial plantings at a number of points in northern Florida, being associated especially with situations where oak trees were prevalent prior to clearing. In a 100-acre block near LaCrosse 69 trees were found in various stages of decline from this disease, 41 of these occurring in one local area, and numerous others had been removed previously.

Pellicularia koleroga (Corticium stevensii) thread blight, was of widespread occurrence and proved troublesome to trees on 130 acres of a large planting at Lamont. The disease was confined chiefly to the lower-lying land, especially where the trees were closely planted. In the lowest portion adjacent to the hammock forest virtually all the trees exhibited more or less of the disease. The company spent nearly $800 in pruning 30 acres of trees in an attempt to control the disease, but with little evidence of success. Spraying, however, has proved very effective. Trees sprayed once in 1942 and again during the summer of 1943 appeared fairly free from the disease.

AMYGDALUS PERSICA, PEACH. Cercosporella persicae, frosty mildew, was found attacking the leaves of 2 trees at Melrose.

CARYA ILLINOENSIS, PECAN. Cercosporella caryigena (Mycosphaerella caryigena), downy spot, was found occasionally on trees at Monticello. Cladosporium effusum, scab, was of widespread occurrence on various varieties at Monticello and other points, causing a heavy dropping of nuts in some cases. Elsinoë randii, nursery blight, was observed occurring commonly in one nursery at Monticello, causing extensive defoliation and a ragged, unsightly appearance of seedlings. Microsphaera alni, powdery mildew, was found occasionally on nuts in 2 orchards at Monticello. Pestalotia uvicola was associated with large, irregular dead areas on leaves of trees in one orchard at Monticello. Phoradendron flavescens, mistletoe, was observed occurring with great frequency at most localities throughout Florida where pecans have been planted, ranging from Dunedin on the lower West Coast to Cocoa on the middle East Coast and northward to Monticello and DeLand. It frequently grows in great profusion on old, neglected trees.

CITRUS. Citrus groves in Volusia, Lake, Orange, Brevard, Polk, Highlands and Pinellas Counties appeared to be in finer condition in general than ever before. This is due to the widespread use of dolomitic limestone and other soil amendments and nutritional sprays that has become the general practice during the last few years. As a result of this modern program of fertilization, groves are now characterized by much less gummosis and less dead wood from bronzing, frenching, exanthema (dieback) and other diseases now conceded to result from deficiencies or lack of availability of certain essential nutritional elements. The reduction of these widespread causes that formerly contributed so greatly to the production of dead wood has in turn brought about a great reduction in the prevalence and severity of melanose.

Melanose (Diaporthe citri) was reported to be worse than usual this year in the vicinity of DeLand, owing to the cold in February, and also in Polk and Pinellas Counties, owing to rainy weather following blooming. Scab (Elsinoë fawcetti) did not appear to be particularly troublesome in any of the sections visited. These diseases, which were formerly regarded as serious factors in reducing fruit grade and marketability, are now considered relatively unimportant from an economic standpoint owing to the use of such a large proportion of the fruit for canning. Melanose is still an important factor in citrus fruit production, however, from the standpoint of the Phomopsis type of stem-end rot.

Botryodiplodia diplocarpa was found to be of general occurrence on dying branches of Tahiti lime trees in a rather neglected grove between Lotus and Tropic on Merritt Island. It causes a bluish-black discoloration of the wood similar to that caused by Diplodia natalensis (Physalospora rhodina), but appears to be essentially secondary on branches weakened or dying from various causes.

Stylar-end rot of Tahiti limes, considered to be a physiological breakdown of maturing fruit, also occurred to some extent on the more mature fruit on a number of trees in the same grove.

Clitocybe tabescens, Clitocybe root rot, was observed to have developed on 3 additional grapefruit trees on rough lemon stock in a grove at Waverly where this disease has been prevalent for a number of years. Ustulina vul-

garis was found fruiting at the base of two trees and Ganoderma applanatum var. tornatum on the other. These 2 fungi have been observed by the writer in former years in this particular grove, occurring as secondary fungi on trees attacked by Clitocybe root rot.

Phytophthora parasitica, foot rot, continues to cause decline and death of trees, especially in those sections where sweet seedling orange trees are grown.

Decline of trees on rough lemon stock was observed to be prevalent throughout the ridge section from Lake Alfred south to Lake Placid and also in Pinellas County on the West Coast. This trouble has been occurring for many years but the cause has not been determined. It usually occurs sporadically on trees in certain groves and appears to develop most frequently in situations where they are periodically subject to drought. Tree losses are causing some growers considerable concern.

Saline irrigation water proved extremely injurious in a number of groves in the Indian Rocks, Seminola and Annona sections of Pinellas County, resulting in extensive defoliation and dying back of large bearing trees. The water table has been materially lowered over a period of years by excessive drainage and by subnormal rainfall over a period of years. Groves suffered so severely from drought during the past year that it was necessary to irrigate over a period of 9 out of 11 months. After irrigating for some time it was found that the water pumped from artesian wells had become quite saline in some instances. Analyses of the water showed a wide variation in salt content and in one or two instances showed about 4800 p.p.m. of NaCl. Samples taken from various wells showed that the salt content often increased greatly after but from 2 to 3 hours of pumping.

Cuscuta americana, dodder, was found forming an extensive mat enveloping the tops of 2 large bearing orange trees in a grove in the Eloise section near Winter Haven.

Vines that overrun trees and cause injury in citrus groves are reported in PDR 27:692-693.

MALUS SYLVESTRIS, APPLE. Pestalotia sp. was found associated with a leaf spot on a single small tree 5 miles north of Milton. The spots were small and the disease appeared to result in no appreciable damage.

MORUS NIGRA, BLACK MULBERRY. Cercosporella mori, leaf spot, was collected at Quincy, Greenville, and Gainesville, sometimes being sufficiently severe to cause extensive defoliation.

PSIDIUM GUAJAVA, COMMON GUAVA. Colletotrichum gloeosporioides (Glomerella cingulata), ripe rot, was of frequent occurrence at Tropic, Merritt, and later at Homestead, the disease apparently gaining entrance at times through insect punctures.

VITIS MUNSONIANA, BIRD GRAPE. Phyllosticta viticola, the conidial stage of Guignardia bidwellii, leaf spot, was of frequent and widespread occurrence throughout central and southern Florida, occurring with great profusion on Key Largo.

VITIS ROTUNDIFOLIA, MUSCADINE GRAPE. Phyllosticta viticola, leaf spot, occurred abundantly on wild vines at Quincy. Septoria ampelina, leaf spot, also occurred abundantly in the same locality. A large leaf-blotch caused by an as yet undetermined Sphaeronema-like fungus was collected on wild vines between Bristol and Telogia.

VITIS RUFOTOMENTOSA, REDSHANK GRAPE. Plasmopara viticola, downy mildew, occurred abundantly on vines in one locality between Newman's Lake and Orange Heights. An unusual fungus with grayish spore masses borne in rounded heads on stalks, apparently a species of Diplococcum, also occurred on other leaves of the same vines, causing a distinctive, irregularly zonate type of spot.

VITIS VULPINA, FROST GRAPE. Isariopsis clavispora, leaf blotch, was of infrequent occurrence between Micanopy and McIntosh.

SPECIAL CROPS

ARACHIS HYPOGAEA, PEANUTS. Cercospora leaf spot was of general occurrence in all of the many fields examined from Marion and Alachua Counties in north-central Florida to Escambia County at the extreme western end of the State. This disease usually resulted in defoliation ranging from 25 - 35%, and in one case 50%, in undusted fields. The small, short-spored spot (Cercospora personata) was the predominant one found in material examined from Marion, Alachua, Jackson, Jefferson, Santa Rosa, Okaloosa and Escambia Counties. The large, long-spored leaf spot (Cercospora arachidicola) was noted only in plantings at Aucilla, Quincy, and near Crestview. Good control of this disease was secured by dusting in tests conducted by the North Florida Experiment Station at Aucilla and Allentown. In the former locality sulfur dust was found to have given about 18% increase over undusted plots and copper-sulfur dust about 2-3% higher increase in yield of nuts on the Florida Runner variety.

Decay of nuts was reported in one field near Allentown. The nuts examined showed evidence of Rhizoctonia, and Diplodia natalensis was observed fruiting on lesions on stems of the same plants.

GOSSYPIUM spp., COTTON. Diplodia natalensis (Physalospora rhodina) was of more or less general occurrence as a cause of boll rot in many of the cotton fields visited late in the season in Jackson, Holmes, Santa Rosa and Escambia Counties.

Diplodia natalensis and Sclerotium bataticola (Macrophomina phaseoli) were both associated with a widespread dying of mature plants in one field at Madison, where plants were said to have been dying gradually since the seedling stage, resulting in about 25% loss. The latter fungus was associated with a similar dying of mature plants in a field 10 miles east of Tallahassee.

HIBISCUS SABDARIFFA, ROSELLE. Heterodera marioni, rootknot, was found infecting roots of a test planting of this crop with extreme severity, on nematode-infested land at the North Florida Experiment Station.

RICINUS COMMUNIS, CASTOR BEAN. Botrytis cinerea, gray mold, occurred abundantly in a plot-planting at Gainesville, attacking the inflorescences in various stages of development. This disease, which has been of frequent occurrence in parts of Florida for a considerable number of years, spreads rapidly during the warm, humid rainy summers and constitutes a serious hindrance to seed production.

SACCHARUM, SUGARCANE. The numerous plantings examined in north and west Florida appeared to be remarkably free from diseases, though in some cases adversely affected by dry weather. Plantings of this crop in the northern

part of the State are now limited largely to 3 disease-resistant varieties. Eye-spot (Helminthosporium ocellum) occurred to some extent in one planting near Perry but did not constitute any appreciable factor of loss. Mosaic (virus) was noted only in small patches of one of the old-time varieties at Quincy and Oak Grove. In both cases adjacent plantings of resistant varieties were free from this disease.

TREES, ORNAMENTALS, AND MISCELLANEOUS HOSTS

Observations already summarized on occurrence of Clitocybe root rot, mistletoe, dodder, wood-rotting fungi, entomogenous fungi, lightning stroke etc., on woody plants, are not repeated here. (See PDR 27 (19): 486, Oct. 7; (20): 556, Oct. 15; (22): 632, Nov. 1; (23): 636-637, Nov. 15; (24): 694-696, 697, Dec. 1, 1943; and PDR 28 (7): 260-272, Apr. 1, 1944).

ACER CAROLINIANUM. Rhytisma acerinum, tar spot, was observed at Suwanee Springs and at Suwanee Gables east of Old Town.

AESCULUS PAVIA, RED BUCKEYE. The Phyllosticta stage of Guignardia aesculi was found causing leaf blotch and defoliation of a single tree in Torreya State Park.

ARECASTRUM ROMANZOFFIANUM, PLUMY COCONUT. Ganoderma zonatum (G. sulcatum) was observed fruiting at the bases of dying trees at Cocoa and Clearwater. Curly-top (manganese deficiency) was noted in young palms at Sebring, Dunedin, and various points along the East Coast.

ASIMINA OBOVATA, BIGFLOWER PAWPAW. Cercospora asiminae, leaf spot, was found on plants at DeSoto City.

BACCHARIS HALIMIFOLIA, EASTERN BACCHARIS. Dimeriella melioides, black mildew was found on leaves of plants at Juniper Springs, Umatilla, near Meritt Island, and between Jensen and Stuart.

BIGNONIA CAPREOLATA, CROSSVINE. Capnodium elongatum, sooty mold, was collected in Sanchez Hammock 10 miles northwest of Gainesville. Meliola bidentata, black mildew, was found occurring fairly commonly at Gainesville and points in the vicinity.

BOERHAAVIA ERECTA, ERECT SPIDERLING. Albugo platensis, white rust, was of common occurrence on this plant growing as a weed in a pecan grove at Monticello.

BROUSSONETIA PAPYRIFERA, PAPER MULBERRY. Cercospora broussonetiae, leaf spot, was observed at Quincy.

CALLICARPA AMERICANA, AMERICAN BEAUTYBERRY. Cercospora callicarpae, leaf blotch, was collected at Melrose.

CALONYCTION ACULEATUM, MOONVINE. Albugo ipomoeae-panduranae, white rust, was collected at Bonaventure.

CATALPA BIGNONIOIDES, SOUTHERN CATALPA. Cercospora catalpae was observed to be causing extensive spotting and defoliation of roadside trees near the entrance to Torreya State Park.

CEDRUS DEODARA, DEODAR CEDAR. Clitocybe tabescens, Clitocybe root rot, was found to have practically killed an ornamental tree planted in a residential property at Quincy. The disease stimulated a profuse exudation of resin from the base of the trunk, and upon dissection of the trunk it was found that extensive zones of pathologic resin canals had developed

in the growth rings formed after the disease had attacked the tree, some of the canals being continuous from the base to the tip of the tree, which was about 13 feet high. The wood of Cedrus normally is characterized by the complete lack of resin canals. Pure cultures of the fungus were secured in isolations made from the roots.

CHAENOMELES JAPONICA, JAPANESE FLOWERING QUINCE. Cercospora cydoniae, leaf spot, was of common occurrence on a few ornamental bushes at both Monticello and Quincy, resulting in almost complete defoliation in all cases.

CORNUS spp., DOGWOOD. Cercospora cornicola, leaf spot, was causing extensive defoliation of ornamental trees of flowering dogwood, C. florida, at Gainesville and Quincy. Meliola nidulans, black mildew, was fairly common at times on plants of small-fruited dogwood, C. microcarpa, about Gainesville and Silver Springs. The fungus develops profusely on twigs and even good-sized stems.

CRATAEGUS spp., HAWTHORN. Entomosporium maculatum, the conidial stage of Fabraea maculata, leaf blight, was observed to be causing considerable defoliation of trees of Ravenel hawthorn, C. ravenelii, in Sugarfoot Hammock west of Gainesville. Phyllactinia corylea, brown mildew, was found with good development of perithecia, on oneflower hawthorn, C. uniflora, in Sugarfoot Hammock.

CUSCUTA spp., DODDER. C. americana was found on orange trees (PDR 27: 692). C. compacta was found occurring abundantly on a number of native shrubs in the vicinity of lakes and bayheads at Gainesville, Micanopy, Evinston, and Monticello (See PDR 27:556, 696-697; 28: 269).

ELAEAGNUS sp. Cercospora elaeagni, leaf spot, occurred abundantly on a group of these shrubs planted at Oakland. Colletotrichum sp. also occurred in association with these spots.

ELEPHANTOPUS spp. Coleosporium elephantopodis, rust, was collected at Gainesville on stems and leaves of E. carolinianus. The uredinia were parasitized by Ramularia coleosporii. The rust occurred sparingly on plants of E. tomentosus in Torreya State Park.

EMILIA SONCHIFOLIA. Puccinia emiliae, rust, was abundant on plants at Cocoa.

ERYTHRINA HERBACEA, EASTERN CORALBEAN. An apparently new species of Cercospora was found occurring abundantly on leaves of plants in scrub woods at De Soto City, the infected leaves having the appearance of having been attacked by a rust. This is the first record at Gainesville of the occurrence of a Cercospora on this host in Florida.

EUPATORIUM CAPILLIFOLIUM, DOGFENNEL. Cuscuta compacta, dodder, was found occurring abundantly on stems of this tall weed at Evinston and Gainesville.

FRAXINUS CAROLINIA, CAROLINA ASH. Cylindrosporium fraxini, leaf spot, was found occurring abundantly at Newnan's Lake near Gainesville. This appears to be the first record of this disease for Florida and also on a new host for the fungus. The collection was made jointly with Mr. Erdman West.

GORDONIA LASIANTHUS, LOBLOLLYBAY GORDONIA. Meliola cryptocarpa, black mildew, was collected at Altoona.

GREVILLEA ROBUSTA, SILK OAK. Gummosis was observed on the trunk of a large ornamental tree at Leesburg. The cause of this trouble was not apparent but it has been attributed to Diplodia natalensis (Physalospora rhodina) in other instances. In the butt of a recently felled companion tree showing no particular evidence of gummosis, short zones of pathologic gum canals were found in the interior wood, marking a point where gum formation had occurred previously.

HAMAMELIS VIRGINIANA, WITCH HAZEL. Gonatobotryum maculicola, leaf spot, was found in Torreya State Park, this being the first record of this unique fungus in Florida. Records of it heretofore have been confined to a few northeastern States.

HYDROCOTYLE sp., PENNYWORT. Puccinia hydrocotyles, rust, occurred abundantly on this plant on low wet ground along the Indian River at Cocoa.

HYPTIS MUTABILIS, WOOD SAGE. Puccinia hyptidis-mutabilis, rust was found to occur commonly in the vicinity of Gainesville. It was collected at Windsor and Lowell also.

HYPTIS RADIATA. Puccinia hyptidis, rust, occurred abundantly on plants between Orange Heights and Melrose. A later collection made unusually late in the season in the same locality showed that the rust had become extensively parasitized by Darluca filum.

ILEX CASSINE, DAHOON. Cercospora ilicicola, leaf spot, was found occurring sparingly at Melrose. This fungus does not appear to have been recorded from Florida previously. Capnodium elongatum, sooty mold, occurred abundantly on bushes in the same locality.

Englerulaster orbicularis, black spot, occurred so profusely on leaves of bushes in the same locality and also in Sanchez Hammock near Gainesville as to greatly reduce the value for Christmas decorations. Although the fungus was immature it was commonly overrun in both these localities by silvery gray patches of mycelium but there was no evidence of sporulation by this apparently parasitic fungus.

Pestalotia annulata, was found causing large leaf spots, mostly terminal on plants at Umatilla.

Phacidium curtisii, tar spot, was found occurring but sparingly on plant at Melrose and only a trace of it was seen on plants in Sanchez Hammock, Silver Springs and other points. The dahoon holly does not appear to be nearly so susceptible to this disease as the American holly.

ILEX CORIACEA, LARGE GALLBERRY. Englerulaster orbicularis occurred abundantly on leaves of plants at Umatilla. Phyllosticta ilicicola, leaf spot, was collected on a few leaves of plants in the same locality.

ILEX OPACA, AMERICAN HOLLY. Capnodium elongatum, was observed in Sanchez Hammock northwest of Gainesville. Englerulaster orbicularis, black spot, was found occurring commonly at various points in the vicinity of Gainesville. Phacidium curtisii, tar spot, was observed to occur commonly in the vicinity of Gainesville.

IPOMOEA TRICHOCARPA. Puccinia crassipes, rust, was found fruiting abundantly on leaves of vines at Ocala, occurring in association with Coleosporium ipomoeae.

ITEA VIRGINICA, VIRGINIA SWEETSPIRE. Septobasidium sinuosum, felty fungus, was collected at Melrose and south of Barberville, the collections being limited to a single specimen in each case. This is a hitherto unreported host record for the occurrence of this fungus.

Tryblidiella rufula was found occurring abundantly on dead twigs of shrubs south of Barberville and at Glencoe, 3 miles west of New Smyrna.

LANTANA SELLOWIANA, TRAILING LANTANA. Puccinia lantanae, rust, was collected at Gainesville.

LEONOTUS NEPETAEFOLIA, LIONSEAR. Puccinia leonotodis (P. Henn.) Arth., II, rust, was collected on this plant growing as a weed in an abandoned sand pear orchard 7 miles north of Ocala on November 8, 1943. This collection, the determination of which was verified by Dr. George B. Cummins, is the first record of the occurrence of this rust in the United States, it being previously known in the West Indies.

LIQUIDAMBAR STYRACIFLUA, SWEETGUM. Conopholis americana, squaw-root, was found growing from roots of trees in Sanchez Hammock northwest of Gainesville and at Magnesia Springs.

LYONIA FERRUGINEA, FETTERBUSH. Exobasidium vaccini, leaf galls, were of fairly common occurrence on plants at Altoona. Phacidium nigrum, tar spot, was observed occurring commonly in the vicinity of Gainesville, near Lynne on the Ocala National Forest, and west of Astor Park.

LYONIA LIGUSTRINA var. FOLIOSIFLORA, BRACTED HE-HUCKLEBERRY. Pucciniastrum myrtilli, rust, was observed occurring sparingly at Micanopy. Rhytisma andromedae-ligustrinae, tar spot, was collected on senescent leaves of the same plants.

MAGNOLIA VIRGINIANA, SWEETBAY MAGNOLIA. Meliola magnoliae, black mildew, was a common leaf blemish at Melrose. Phyllosticta glauca, leaf spot, was found to be of extremely common and widespread occurrence, collections having been made at a number of points from Crestview and DeLand south to Royal Palm State Park. Where leaf infections are abundant considerable defoliation results.

Phyllosticta magnoliae, leaf spot, was found causing extensive defoliation at Longwood. This disease is very similar to the preceding except that the spots average considerably larger and the spores are larger and not rod-like as in the preceding.

MELIA AZEDARACH, CHINABERRY. Cercospora leucosticta, leaf spot, was observed occurring abundantly on a tree south of Lotus on Merritt Island and to be of common occurrence on trees at Gainesville.

MYRICA CERIFERA, SOUTHERN WAXMYRTLE. Irenina manca, black mildew, was found occurring fairly abundantly in the vicinity of Gainesville, Melrose, along the Ocklawaha River several miles east of Silver Springs, Barberville, and in Royal Palm State Park.

Galls (cause unknown) were observed rather commonly on stems of bushes in the vicinity of Gainesville, Melrose and Juniper Springs. In the younger galls the bark was intact but in older ones promienent circular to elongated swellings occurred and the hypertrophied wood tissue was devoid of bark on the older part. This gall formation was observed in former years on waxmyrtle and also flameleaf sumac (Rhus copallina) on Merritt Island.

NERIUM OLEANDER, OLEANDER. Sphaeropsis sp., witches' broom, was observed on a number of ornamental bushes at Sanford, DeLand, Cocoa, City Point, Eau Gallie, Miami, and Coconut Grove. This disease is reported to have become increasingly widespread and destructive about Miami during the last few years. It characteristically appears again in the new growth that develops after infected plants are cut back severely, thus appearing to

be systemic. Witches' brooms were found to have developed in the first growth that put out in 2 of a series of cuttings being propagated at the Deering Estate.

NYSSA OGECHE, OGEECHEE TUPELO. An unidentified leaf spot was observed to be causing extensive defoliation of trees along the road between Chipley and Bonifay and in the river bottom on the Holmes-Washington County line. No disease has been reported on this tree in Florida previously. Unfortunately, the fungus was not fruiting and could not be identified.

OPUNTIA, PRICKLYPEAR. Perisporium wrightii, black spot, was observed to occur fairly commonly at Altoona, between DeLand and Orange City, and at Orlovista. In previous years the writer has found this disease occurring commonly on various species of Opuntia along the East Coast from Vero Beach north to near St. Augustine.

OSMANTHUS AMERICANUS, DEVILWOOD OSMANTHUS. Capnodium elongatum, sooty mold, was found occurring abundantly at Gainesville. Meliola sp., was of common occurrence at Gotha. The fungus has been considered to be M. amphitricha Fr. but this vague species was excluded by Stevens in his monograph of the genus. Phyllosticta sinuosa, leaf spot, was of widesprea[d] occurrence in western Florida, collections having been made 10 miles northwest of Perry and at Torreya State Park.

PERSEA HUMILIS, SILKBAY PERSEA. Phyllosticta micropuncta, leaf spot, was observed in scrub woods west of Astor Park.

PHORADENDRON FLAVESCENS, MISTLETOE. This parasitic plant was found to be of widespread and frequent occurrence throughout northern and central Florida but appears to occur infrequently in western Florida and on the lower East Coast. It extends southward in the State at least to Lake Placid and Clearwater and was recently found on Key Largo. It occurs most frequently on various oaks, including laurel, water, turkey, bluejack, and myrtle oaks, hickory, pecan, swamp black gum tupelo, and black cherry. It occurs with extreme frequency in areas of oak scrub. Mistletoe has been recorded as occurring on more than 50 species of trees and shrubs in the State. Host records have been reported in PDR 27(23):637-638, Nov. 15, 1943, and 28 (7):262-269, April 1, 1944.

Sphaeropsis visci, leaf blight, hitherto unreported for Florida, has been found to be of very common and widespread occurrence. Other fungi found on mistletoe are Septobasidium pseudopedicellatum, and Tryblidiella fusca, new host records in both cases (PDR vol. 28, p. 269).

PINUS spp., PINE. Cronartium fusiforme, southern fusiform rust, was found occurring occasionally on P. caribaea, slash pine, at points about Alachua County and in various counties in western Florida. It occurs to some extent in planted slash pine forests in Suwannee County. The disease appears to occur much less frequently on this host than on Pinus taeda or P. echinata. It was found occurring frequently in various west Florida counties on P. echinata, shortleaf pine, being especially abundant between Tallahassee and Quincy and about Quincy. It was of common occurrence on P. taeda, loblolly pine, in Alachua, Jefferson, Gadsden, Taylor and Dixie Counties. It frequently attacks young trees with great severity, often seriously deforming them.

PLEIOBLASTUS CHINO. Puccinia melanocephala, rust, was found occurring on this bamboo which had escaped from cultivation and become a veritable pest. The uredinia were extensively parasitized by Monosporium uredinicolum Stevens. Meliola tenuis, black mildew, also occurred on other

plants in the same locality.

QUAMOCLIT VULGARIS, CYPRESSVINE. Coleosporium ipomoeae, rust, was found causing extensive infection on vines between Largo and Seminole.

POINSETTIA HETEROPHYLLA. Uromyces proeminens var. poinsettiae, rust, was of common occurrence on this weed at Tropic, Merritt Island.

POLYCODIUM FLORIDANUM, DEERBERRY. Pucciniastrum myrtilli, rust, was found causing slight infection on plants at Cocoa. Rhytisma vaccinii, tar spot, occurred to some extent on plants at Cocoa and in great profusion on large numbers of plants in the scrub woods at Altoona.

PRUNUS CAROLINIANA, CAROLINA LAURELCHERRY. Exudation of gum from the base of a young street tree was observed at Quincy but no cause was found. Another adjacent, similarly affected tree that had just been sawed off at the ground showed more or less concentric series of pathologic resin canals developed in the wood.

QUERCUS spp., OAK. Microsphaera alni, powdery mildew, was found on leaves of young laurel oaks, Q. laurifolia, at Gainesville, Evinston, Oak Hill, and Titusville. Oidium sp., probably the conidial stage of M. alni, was found on a young white oak tree, Q. alba, in Torreya State Park, but perithecia were lacking.

Trabutia erythrospora, tar spot, was of common occurrence on old leaves of live oak, Q. virginiana, trees at Gainesville, Melrose, and Brooksville. The fungus does not appear to develop mature spores until some time after the leaves have fallen.

Wood-rotting fungi were reported in PDR 28(7):261-262.

Conopholis americana, squaw root, was found growing from roots of laurel oak trees in Sanchez Hammock 10 miles northwest of Gainesville and at Magnesia Springs, and from roots of a water oak, Q. nigra, at the latter place.

Phoradendron flavescens, mistletoe, was observed to be common especially on laurel oak. See PDR l. c., under Phoradendron.

RHUS COPALLINA, FLAMELEAF SUMAC. Cercospora rhuina was found to be of widespread occurrence throughout north central and central Florida, frequently causing premature shedding of the attacked leaflets.

ROSA PALUSTRIS, SWAMP ROSE. Phragmidium speciosum, rust, was found producing telia on a single stem tip in Sugarfoot Hammock west of Gainesville, where it has been observed in former years. The uredinial stage was found overwintering on persistent leaves in another locality at Gainesville.

RUBUS ? ARGUTINUS, BLACKBERRY. Irenina manca, black mildew, was abundant on plants at Altoona.

SABAL ETONIA, ETONIA PALMETTO. Myriangium sabaleos Weedon, leaf spot, was found at De Soto City. This is a new host record for this little known fungus, which appears to have been known only on cabbage palmetto, (Sabal palmetto), on which it was described from a collection made at St. Petersburg in 1923. As Miller has pointed out (Mycologia 32:589. 1940), this does not appear to belong to Myriangium.

SABAL PALMETTO, CABBAGE PALMETTO. Ganoderma zonatum (G. sulcatum Murr.), which occasionally attacks palms, was observed fruiting at the base of a living tree at Longwood. These species are now regarded as synonymous by Dr. Murrill, the former having priority.

SERENOA REPENS, SAW PALMETTO. Meliola palmicola, black mildew, was found to be an extremely common and widespread disease, it having been observed at many points throughout northern and central Florida.

SIDA spp., TEAWEED. Ramularia areola, frosty mildew, was found causing widespread infection of plants of Sida carpinifolia at points about Gainesville and Citra, of S. acuta at Umatilla, and of S. rhombifolia at Bonaventure.

SMILAX AURICULATA. Capnodium elongatum, sooty mold, was found in Sanchez Hammock 10 miles northwest of Gainesville. Cercospora smilacis, leaf spot, occurred abundantly at De Soto City.

SMILAX LAURIFOLIA, LAUREL GREENBRIER. Cercospora smilacis, leaf spot, occurred abundantly 10 miles northwest of Perry. Pestalotia funerea was found associated with a leaf spot at Umatilla.

TILIA FLORIDANA, FLORIDA LINDEN. Conopholis americana, squaw-root, was found growing from roots of a tree at Magnesia Springs.

VACCINIUM ARBOREUM, FARKLEBERRY. Ophiodothella vaccinii was of common occurrence as a cause of leaf spot at Suwanee Springs, Altoona, and Eustis.

VERBESINA VIRGINICA, WHITE CROWNBEARD. Coleosporium viguierae, rust, occurred abundantly on plants near Merritt Island P. O., Merritt Island and on Hypoluxo Island.

VERNONIA OVALIFOLIA. Coleosporium vernoniae, rust, caused heavy infection of plants in Torreya State Park.

XANTHIUM AMERICANUM, COCKLEBUR. Erysiphe cichoracearum, powdery mildew, was found attacking leaves of plants near Milton, Allentown and Oak Grove at the western end of Florida, and also at Ocala. Puccinia xanthii attacked plants severely at Allentown and Oak Grove and less so at Ocala.

PLANT DISEASES OBSERVED IN ALABAMA IN 1943

G. M. Stone and J. L. Seal

VEGETALBE CROPS

ABELMOSCHUS ESCULENTUM OKRA. Leaf spots caused by Cercospora althaeina and Phyllosticta hibiscina were found scattered in most plantings, causing no apparent damage. Rootknot (Heterodera marioni) and Fusarium wilt (F. oxysporum f. vasinfectum) were of major importance and caused severe damage in a high percentage of gardens especially in the southern part of the State.

BRASSICA OLERACEA var. ACEPHALA, COLLARDS. Rootknot (Heterodera marioni) was prevalent in the southern part of the State, causing more damage than other diseases. Only scattered infections of blackleg (Phoma lingam) and ringspot (Mycosphaerella brassicicola) were observed. Black rot (Xanthomonas campestris) (Bacterium campestre) was more prevalent than blackleg but did not occur in sufficient amount to cause much damage.

BRASSICA OLERACEA var. CAPITATA, CABBAGE. Rootknot (Heterodera marioni) was of major importance, being prevalent in the southern section and causing moderate damage in many fields. Black leaf spot (Alternaria circinans)

was of minor importance; it became prevalent late in the season after most of the cabbage had been cut. Black rot (*Xanthomonas campestris*) and bacterial soft rot (*Erwinia carotovora*) were of greater importance than black leaf spot; they were destructive in occasional plantings. Only a few infections of black leg (*Phoma lingam*) and yellows (*Fusarium oxysporum* f. *conglutinans*) were seen. Southern blight (*Scloerotium rolfsii*) occurred in occasional plantings.

BRASSICA RAPA, TURNIP. Rootknot (*Heterodera marioni*) was the most prevalent disease and caused considerable damage to many plantings in the southern part of the State. Scattered infections, with little damage, of black rot (*Xanthomonas campestris*), leaf spot (*Colletotrichum brassicae*), and mosaic (virus), were observed.

IPOMCEA BATATAS, SWEETPOTATO. Rootknot (*Heterodera marioni*) was of major importance in the southern part of the State. Scurf (*Monilochaetes infuscans*) was fairly general. In some crops a high percentage of the plants were affected, but little damage resulted. Stem rot (*Fusarium oxysporum* f. *batatas*) was generally distributed over the State but less than 1% of the plants were infected. Leaf spot (*Phyllosticta batatas*) was of minor importance; although it was found in most fields, no apparent damage resulted. Java black rot (*Diplodia tubericola*) was found occasionally in the southern part of the State. Dry rot (*Diaporthe batatatis*) was common in storage but losses usually were low.

LYCOPERSICON ESCULENTUM, TOMATO. Diseases of major importance were *Fusarium* wilt (*F. oxysporum* f. *lycopersici*), which was general and caused losses that were quite often heavy where susceptible varieties were grown, especially in home gardens, and early blight (*Alternaria solani*), southern blight (*Sclerotium rolfsii*), and mosaic (virus), all of which were more prevalent in 1943 than usual and caused moderate damage.

Bacterial wilt (*Pseudomonas solanacearum*) was found to cause considerable damage in quite a few plantings in the southern part of the State.

Blossom-end rot (physiogenic) was general, being found in almost every planting seen, but losses were not great.

Leaf spot (*Septoria lycopersici*) was rather prevalent but caused little damage.

Anthracnose (*Colletotrichum phomoides*), bacterial canker (*Corynebacterium michiganense*), bacterial spot (*Xanthomonas vesicatoria*), gray mold rot (*Botrytis cinerea*), and stem rot (*Rhizoctonia solani*), were of slight importance, being found only occasionally.

PHASEOLUS VULGARIS, GREEN BEANS. Rootknot (*Heterodera marioni*), a root rot caused by *Diaporthe* sp., and southern blight (*Sclerotium rolfsii*), were the most important diseases, causing moderate to severe damage in many fields.

Mosaic (virus) was general, and considerably more prevalent in 1943 than usual. Damage was moderate.

Powdery mildew (*Erysiphe polygoni*) and rust (*Uromyces phaseoli* var. *typica*) were general, but of no consequence on the early crop. Both were more severe on the late crop.

Bacterial blight (*Xanthomonas phaseoli*) was not very prevalent and caused moderately low damage.

Anthracnose (*Colletotrichum lindemuthianum*), bacterial wilt (*Pseudomonas solanacearum*), black root rot (*Thielaviopsis basicola*), leaf blotch (*Cercospora cruenta*), and stem rot (*Sclerotinia sclerotiorum*), were each found

in a few plantings, causing slight damage.

SOLANUM TUBEROSUM, POTATO. Early blight (Alternaria solani) was more destructive than usual and was of major importance on the early crop. Scattered infections of bacterial wilt (Pseudomonas solanacearum) and Fusarium wilt (F. oxysporum) were noted; less than 1% of the plants were affected. Scab (Actinomyces scabies) was of minor importance, as was also soft rot (Bacillus sp.) which was less prevalent than usual. Only an occasional plant affected by southern blight (Sclerotium rolfsii) was noted.

CEREALS AND FORAGE CROPS

AVENA SATIVA, OATS. Crown rust (Puccinia coronata) is of major importance on oats in Alabama. Infections in 1943 were moderate. Loose smut (Ustilago avenae) was prevalent in fields from untreated seed but losses were considerably less than those caused by crown rust.

HORDEUM VULGARE, BARLEY. A root rot caused by a species of Helminthosporium was of major importance in the "black belt" of Alabama and caused severe damage to early plantings. Both loose and covered smuts (Ustilago spp.) are prevalent in the State and rather destructive where seed treatments are not practised. Leaf spot (Helminthosporium sativum) and powdery mildew (Erysiphe graminis) were found in most fields but apparently caused little damage.

LUPINUS ANGUSTIFOLIUS, BLUE LUPINE. Both Fusarium wilt (F. oxysporum f. vasinfectum) and southern blight (Sclerotium rolfsii), which are usually of minor importance, were considerably more prevalent than usual in 1943 and caused moderate damage.

PISUM SATIVUM var. ARVENSE, AUSTRIAN WINTER PEA. Blight and root rot caused by Ascochyta sp. is the most important disease of this plant in Alabama and is often the limiting factor in growing it. In 1943 it was less severe than usual and caused moderate losses.

Downy mildew (Peronospora pisi) was less prevalent than Ascochyta blight; however, it was more severe than usual and caused moderate loss.

SOJA MAX, SOYBEAN. The most important diseases are mosaic (virus) which was more prevalent than usual, and southern blight (Sclerotium rolfsii) which occurred in the usual amounts; both caused moderate loss.

A number of diseases usually considered of minor importance were more prevalent in 1943 than usual and caused moderate damage in some plantings; these include bacterial leaf spot (Pseudomonas glycinea), downy mildew (Peronospora manshurica), and pod and stem blight (Diaporthe sojae), and also frog-eye leaf spot (Cercospora sojina) which caused less injury than the others.

SORGHUM VULGARE, SORGHUM. Leaf spot (Ascochyta sp.) was of major importance and caused severe damage in many fields. Leaf blight (Helminthosporium turcicum) and bacterial stripe (Pseudomonas andropogoni) occurred generally to a moderate extent, causing severe damage in an occasional field. Anthracnose (Colletotrichum lineola) was of minor importance, only occasional infections being noted.

TRIFOLIUM PRATENSE, RED CLOVER. Powdery mildew (Erysiphe polygoni) was more prevalent than usual, occurring generally and causing moderate damage. Anthracnose (Colletotrichum trifolii) was less prevalent than usual, only scattered infections being observed.

TRIFOLIUM REPENS, WHITE CLOVER. Rootknot (Heterodera marioni), the most important disease, caused moderate damage. Leaf spot (Cercospora sp.) was more prevalent than usual and caused slight to moderate damage. Botrytis blight (Botrytis sp.), leaf blight (Stagonospora sp.), and southern blight (Sclerotium rolfsii), were less prevalent than usual.

TRITICUM AESTIVUM, WHEAT. Leaf rust (Puccinia rubigo-vera var. tritici) is the most destructive wheat disease in Alabama. Infection in 1943 was general and moderately heavy. Loose smut (Ustilago tritici) was found in most fields but losses were low. Speckled leaf blotch (Septoria tritici) was found scattered in most fields with no apparent damage resulting. Only a slight amount of scab (Gibberella zeae) was seen in 1943.

VICIA spp., VETCH. Blight and root rot caused by Ascochyta sp. is of major importance on common vetch; however, in 1943 it was less prevalent than usual and caused only slight to moderate damage.

Red rot (cause unknown), usually of major importance on monantha vetch, was less severe than usual, with slight to moderate damage.

VIGNA SINENSIS, COWPEA. Rootknot (Heterodera marioni), southern blight (Sclerotium rolfsii) and Fusarium wilt (F. oxysporum f. tracheiphilum), were found frequently on susceptible varieties in the southern part of the State. Powdery mildew (Erysiphe polygoni) was considerably more prevalent than usual, especially late in the season, and late crops were damaged materially. Scattered infections, causing little damage, of bacterial spot (Pseudomonas syringae) and Cercospora spot (C. cruenta), were noted.

ZEA MAYS, CORN. Dry rot (Diplodia zeae) and Fusarium ear rot (F. moniliforme) were more prevalent than usual. Smut (Ustilago maydis) was found in most fields but less than 1% of the plants were affected. Infection by brown spot (Physoderma zeae-maydis) was heavier in 1943 than usual but damage was considered slight. Leaf blight (Helminthosporium turcicum) occurred in scattered infections causing little damage.

FRUIT CROPS

FRAGARIA, STRAWBERRY. The stem nematode, Ditylenchus dipsaci, and the rootknot nematode, Heterodera marioni, were of major importance. Apparently the stem nematode caused greater damage.

Scattered infections by angular spot (Dendrophoma obscurans), leaf spot (Mycosphaerella fragariae), and powdery mildew (Sphaerotheca humuli) occurred in most plantings, apparently causing no damage.

Crown rot (Pellicularia filamentosa) (Corticium vagum) was observed occasionally.

Of the fruit rots, leak (Rhizopus nigricans), was of major importance and caused moderate to heavy losses, especially with poor handling. Brown rot (Rhizoctonia) and gray mold rot (Botrytis cinerea) were noted in occasional infections.

SPECIAL CROPS

ARACHIS HYPOGAEA, PEANUT. Bacterial wilt (Pseudomonas solanacearum) occurred in scattered infections in the southern part of the State and was of only slight importance.

Cercospora leaf spot (C. personata and C. arachidicola) was general over the State. It caused little to no damage in the new peanut-growing areas of the northern part of the State. Infection was much heavier in the "Old Belt", especially when the crop was grown in the same field for the second year. About 10 to 15% loss was caused in the "Old Belt".

Southern blight (Sclerotium rolfsii) was prevalent in the "Old Belt". A high percentage of the plants were infected in many fields but total damage is considered not to be so great as from Cercospora.

GOSSYPIUM, COTTON. Damping-off (seedling diseases) were of major importance although much less abundant this year than usual.

Rootknot (Heterodera marioni) was more prevalent on the sandy soils of southern sections where it is the most important disease.

Fusarium wilt (F. oxysporum f. vasinfectum) was much more prevalent in 1943 than in 1942 and also more prevalent than in the average year.

Blight (Ascochyta gossypii) was considerably more prevalent in 1943 than usual but this disease is considered to be of minor importance.

Angular leaf spot (Xanthomonas malvacearum) was observed in general, but very light infections. Anthracnose (Glomerella gossypii) was found only occasionally. Sparse infections of leaf spot (Alternaria sp.) were noted, with no apparent damage.

SACCHARUM, SUGARCANE. Mosaic (virus) was of major importance. A high percentage of the plants were diseased in susceptible varieties.

Red rot (Colletotrichum falcatum) was of minor importance but caused heavy losses in occasional banks.

LIST OF PLANT DISEASES OBSERVED DURING SURVEYS IN MISSISSIPPI AND LOUISIANA, AUGUST TO NOVEMBER, 1943

L. H. Person

VEGETABLE CROPS

ABELMOSCHUS ESCULENTUS, OKRA. Heterodera marioni, rootknot: Miss.

ALLIUM spp. The following diseases occurred in Louisiana:

A. ASCALONICUM, SHALLOT. Phoma terrestris, pink root; Sclerotium cepivorum, white rot; stunting and yellowing, probable virus.

A. CEPA, ONION. Peronospora destructor, downy mildew; Stemphylium botryosum (Macrosporium parasiticum), stalk rot.

A. SATIVUM, GARLIC. Sclerotium cepivorum, white rot.

BRASSICA OLERACEA var. BOTRYTIS, BROCCOLI. Alternaria circinans (A. brassicae), leaf spot: La. Xanthomonas campestris, black rot: La.

B. OLERACEA var. CAPITATA, CABBAGE. Alternaria circinans, leaf spot: La., Miss. Peronospora parasitica, downy mildew: La. Sclerotinia sclerotiorum, watery soft rot: La. Xanthomonas campestris, black rot: La.

CAPSICUM FRUTESCENS, PEPPER. Southern wilt was noted in both States; the other reports are for La. Cercospora capsici, leaf spot; Colletotrichum nigrum, anthracnose; Fusarium annuum, wilt; Gloeosporium piperatum, anthracnose; Sclerotium rolfsii, southern wilt;

Pseudomonas solanacearum, bacterial wilt; Xanthomonas vesicatoria, bacterial spot; mosaic (virus).

CITRULLUS VULGARIS, WATERMELON. Alternaria cucumerina (Macrosporium cucumerinum), leaf blight: La. Fusarium oxysporum f. niveum, wilt: La., Miss.

CUCUMIS SATIVUS, CUCUMBER. Pseudoperonospora cubensis, downy mildew: La. Pythium sp., cottony leak: La.

IPOMOEA BATATAS, SWEETPOTATO. Actinomyces ipomoea, soil rot: La. Diplodia tubericola, Java black rot: La. Endoconidiophora (Ceratostomella) fimbriata: La. Fusarium oxysporum f. batatas, stem rot and wilt: both States. Heterodera marioni, rootknot: Miss. Monilochaetes infuscans, scurf: La. Phyllosticta batatas, leaf spot: both States. Rhizopus nigricans, soft rot: both States. Sclerotium bataticola, charcoal rot: La. S. rolfsii, stem rot in the plantbed: La. Septoria bataticola, leaf spot: both States.

LYCOPERSICON ESCULENTUM, TOMATO. Alternaria solani, early blight and nailhead spot: La. Corynebacterium michiganense, bacterial canker; La. Fusarium oxysporum f. lycopersici, wilt: La. Heterodera marioni, rootknot; La. Pseudomonas solanacearum, bacterial wilt: both States. Sclerotium rolfsii, southern wilt: both States. Mosaic (virus): La. Blossom-end rot (physiogenic): Miss.

PHASEOLUS LUNATUS, LIMA BEAN. Diaporthe phaseolorum, pod blight, and Sclerotium rolfsii southern wilt: both in Miss.

P. VULGARIS, BEAN. Macrophomina phaseoli, ashy stem blight: Miss. Pythium sp., stem tip blight: Miss. Rhizoctonia microsclerotia, web blight; both States. Rhizoctonia solani: La. (stem canker), Miss. (root rot). Sclerotium bataticola, charcoal stem blight: La. S. rolfsii, southern wilt: both States. Uromyces phaseoli var. typica, rust: both States. Pseudomonas medicaginis var. phaseolicola, halo blight, and Xanthomonas phaseoli, common bacterial blight: both States. Mosaic (virus): La. (on leaf and pod), Miss.

PISUM SATIVUM, PEA. Ascochyta pisi, blight, and Erysiphe polygoni, powdery mildew: both in La.

SOLANUM MELONGENA, EGGPLANT. Phomopsis vexans, fruit rot: La. Sclerotium rolfsii, southern wilt: both States. Pseudomonas solanacearum, bacterial wilt: La.

S. TUBEROSUM, POTATO. Actinomyces scabies, scab: La. Alternaria solani, early blight: La. Phytophthora infestans, late blight: La. Pythium sp., tuber rot: La. Sclerotium rolfsii: La. (tuber rot), Miss. (southern wilt). Corynebacterium sepedonicum, bacterial ringrot: La. Pseudomonas solanacearum, bacterial wilt: La. Virus diseases: mosaic in Miss., mild and rugose mosaic, leaf roll, spindle tuber in La. Haywire (undet.): La.

CEREALS, GRASSES, AND FORAGE CROPS

AXONOPUS COMPRESSUS, CARPET GRASS. Physarum cinereum, slime mold: Miss.

MEDICAGO ARABICA, BURR CLOVER. Colletotrichum destructivum, anthracnose, and C. trifolii, anthracnose: La.

M. SATIVA, ALFALFA. Pleospora herbarum, leaf spot, and Uromyces striatus, rust: La.

MELILOTUS INDICA, SOUR CLOVER. Colletotrichum trifolii, anthracnose, and Entyloma meliloti, white smut: La.

ORYZA SATIVA, RICE. The following diseases were observed in La.: Cercospora oryzae, leaf spot; Entyloma oryzae, leaf smut; Helminthosporium oryzae, brown spot; Hypochnus sasakii, banded sclerotial disease; Leptosphaeri salvinii, stem rot; Piricularia oryzae, blast; Rhizoctonia oryzae, sheath spot; white tip (undet.).

SOJA MAX, SOYBEAN. Except where indicated, these diseases were noted in both States. Cercospora sojina (C. daizu), leaf spot: La. Diaporthe sojae, pod and stem blight. Sclerotium bataticola, charcoal rot. S. rolfsii, southern wilt. Pseudomonas glycinea, bacterial blight. Xanthomonas phaseoli var. sojense, bacterial pustule. Mosaic (virus): La.

SORGHUM VULGARE, SORGHUM. Except where indicated diseases were observed in both States. Ascochyta sorghina, leaf spot: Miss. Cercospora sorghi, leaf spot. Colletotrichum graminicolum, anthracnose. Gloeocercospora sorghi, zonate leaf spot. Puccinia purpurea, rust: La. Titaeospora andropogonis, sooty stripe. Pseudomonas andropogoni, bacterial stripe.

TRIFOLIUM DUBIUM, HOP CLOVER. Erysiphe polygoni, powdery mildew: La.

T. PRATENSE, RED CLOVER. Powdery mildew: La.

T. REPENS, WHITE CLOVER. Cercospora zebrina, leaf spot; Cymadothea trifolii, sooty blotch; and Pseudoplea trifolii, leaf spot: La.

VICIA FABA, BROAD BEAN. Uromyces fabae, rust; and boron deficiency: La.

V. VILLOSA, VETCH. Ascochyta pisi, leaf spot; Colletotrichum sp., anthracnose; and Peronospora viciae, downy mildew: La.

VIGNA SINENSIS, COWPEA. Cercospora vignae, leaf spot: La. Fusarium oxysporum f. tracheiphilum, wilt: La. Macrophomina phaseoli, stem canker: La. Rhizoctonia solani, stem canker: La. Sclerotium rolfsii, southern wilt: Miss. Mosaic (virus): Miss.

ZEA MAYS, CORN. Fusarium moniliforme: La. (ear rot), Miss. (stalk rot). Helminthosporium sp., leaf spot: Miss. Physoderma zeae-maydis, brown spot: both States. Puccinia sorghi, rust: La. Rhizoctonia solani, damping-off: Miss. Ustilago maydis, smut: both States. Mosaic (virus): La.

FRUIT AND NUT CROPS

ALEURITES FORDII, TUNG TREE. Rhizoctonia microsclerotia, web blight: Miss.

CARYA ILLINOENSIS, PECAN. Cercospora fusca, brown spot: both States. Cladosporium effusum, scab: both States. Gnomonia nerviseda, vein spot: Miss. Bunch (virus): La.

CITRUS NOBILIS UNSHIU, SATSUMA ORANGE. Sphaceloma fawcettii, scab: La.

C. PARADISI, GRAPEFRUIT. Sphaceloma fawcettii, scab: La.

C. SINENSIS, ORANGE. Diaporthe citri, melanose: La.

FICUS CARICA, FIG. Macrophoma fici, canker: Miss.
The following diseases were noted in La.: Cephalosporium sp., leaf spot; Corticium sp., leaf blight; C. salmonicolor, twig blight; Pellicularia filamentosa (Corticium microsclerotia), leaf blight; P. koleroga (C. stevensii), twig and leaf blight: Physopella fici, rust.

FORTUNELLA JAPONICA, KUMQUAT. _Diaporthe citri_, melanose: Miss.
FRAGARIA, STRAWBERRY. The following diseases were observed in La.: _Botrytis cinerea_, gray mold; _Diplocarpon earliana_, leaf scorch; _Mycosphaerella fragariae_, leaf spot; _M. louisianae_, purple leaf spot; and _Aphelenchoides fragariae_, dwarf.
MORUS sp., MULBERRY. _Sclerotinia carunculoides_, popcorn disease; Miss.
PYRUS COMMUNIS, PEAR. _Armillaria mellea_, root rot: Miss. _Cercospora minima_, leaf spot: both States. _Clitocybe tabescens_, foot rot: La. _Corticium salmonicolor_, twig blight: Miss. _Fabraea maculata_, leaf spot: both States. _Septobasidium mariana_, felty fungus: Miss. _Erwinia amylovora_, fireblight: both States. _Heterodera marioni_, rootknot: Miss.
VITIS spp., GRAPE AND MUSCADINE. _Guignardia bidwellii_, black rot; and _Rhizoctonia solani_: Miss.

SPECIAL CROPS

ARACHIS HYPOGAEA, PEANUT. _Cercospora personata_, leaf spot; and _Sclerotium rolfsii_, southern wilt: both States.
GOSSYPIUM, COTTON. _Fusarium oxysporum_ f. _vasinfectum_, wilt, and _Xanthomonas malvacearum_, angular leaf spot, were reported in both States. _Verticillium albo-atrum_, wilt, was observed in Miss. The following diseases were noted in La.: _Cercospora gossypina_, leaf spot; _Diplodia gossypina_, boll rot; _Fusarium moniliforme_, seedling rot; _Glomerella gossypii_, anthracnose; _Rhizoctonia solani_, damping-off; _Heterodera marioni_, rootknot; crinkle-leaf associated with high soil acidity and manganese toxicity; and rust due to potassium deficiency.
SACCHARUM, SUGARCANE. The following diseases were noted in La.: _Colletotrichum falcatum_, red rot; _Cytospora sacchari_, sheath rot; _Fusarium moniliforme_, pokkah-boeng; _Pythium_ sp., root rot; _Sclerotium rolfsii_, sheath rot; the virus diseases chlorotic streak and mosaic; and multiple bud of undetermined cause.

TREES AND ORNAMENTALS

CRATAEGUS sp. _Gymnosporangium globosum_, rust: Miss.
GLADIOLUS. _Fusarium_ sp., bulb rot; _Pseudomonas marginata_, stem rot; and _Heterodera marioni_, rootknot: Miss.
IRIS. Mosaic (virus): Miss.
LAGERSTROEMIA INDICA, CRAPE MYRTLE. _Uncinula australiana_, powdery mildew: Miss.
LIGUSTRUM sp., PRIVET. _Microsphaera alni_, powdery mildew: Miss.
MAGNOLIA GRANDIFLORA. _Meliola amphitricha_, sooty blotch: Miss.
PHLOX. _Erysiphe cichoracearum_, powdery mildew: Miss.
PINUS TAEDA, LOBLOLLY PINE. _Systremma acicola_, brown spot: Miss.
POPULUS sp., POPLAR. _Melampsora_ sp., rust: Miss.
RHODODENDRON sp., AZALEA. _Exobasidium azaleae_, hypertrophy: Miss. _Ovulinia azaleae_, flower spot: La.
ROSA. _Sphaerotheca pannosa_, powdery mildew: Miss.

SUMMARY REPORT OF PLANT DISEASES IN ARKANSAS, 1943

Howard W. Larsh with assistance of Arkansas State
Plant Pathologists and crop Specialists.

The 1943 season in Arkansas was abnormal in many respects, as seen in t following climatological data (U. S. Department of Commerce, Weather Bureau. Climatological Data, Arkansas Division Vol. 48 No. 13, Walter C. Hickmon):

	Mean temp.	Departure from long-time average	Mean precipitation	Departure fro long-time avera
Jan.	41.8	+0.6	1.00	-3.31
Feb.	47.5	+3.9	1.00	-2.36
Mar.	46.9	-5.6	5.66	+1.04
April	62.9	+1.4	3.20	-1.73
May	71.0	+1.8	7.89	+2.95
June	79.8	+2.7	2.86	-1.19
July	82.9	+2.3	1.13	-2.59
Aug.	84.6	+4.5	1.03	-2.53
Sept.	70.4	-3.9	3.23	-0.08
Oct.	61.3	-1.5	3.48	+0.27

According to Dr. V. H. Young, the climatological conditions that prevailed during this year produced clear-cut examples of the effect of weather on diseases, and the major facts regarding parasitic and non-parasitic diseases were determined by the adverse weather conditions.

Severe freezes during early March nearly destroyed the Elberta peach crop. Estimations of losses, in commercial orchards, resulting from thes freezes range from 50 to 75%. Spinach plantings were also injured by the freezes of March. A reduction in the strawberry crop resulted from the low temperatures that prevailed near the middle of April. During the lat ter part of April and early May the moisture in the soil began to be depleted thus hindering the germination of seeds and growth of crops; dry weather further injured the spinach and strawberry crops and greatly delayed the planting of corn, cotton, peanuts, and other truck crops. The development and dissemination of fungi were also hindered during this period, this was especially true of "blue mold" of spinach. In early Ma (8-11) torrential rains brought the moisture curve to a very steep peak, causing floods, poor stands in various crops, and still more delay in the planting of other crops. The usual procedure of spraying apples, grapes, and peaches was impossible because of soft ground. Rainfall then decline rapidly and almost no rain fell until late in the fall, resulting in one of the most serious droughts in the recent history of the State.

The months of June, July, and August were extremely dry, and hot weathe persisted causing various crops to deteriorate. In August the precipitation was less than 30% of normal. Cotton opened prematurely; corn and ot crops showed signs of burning due to the extreme drought.

Late maturing crops benefited from the cool days in September and October but fall planted cereals made poor growth. The precipitation during these 2 months was nearly normal.

VEGETABLE CROPS

CAPSICUM ANNUUM, PEPPER. Fruit spot (Alternaria sp.) was prevalent in pepper plantings during 1943. In most of the large plantings a loss of nearly 10% could be attributed to this disease. Many secondary organisms entered the Alternaria lesions, causing further decomposition of the fruit.

Wilted pepper plants collected in the vicinity of Van Buren, revealed a Fusarium upon culturing. A loss of nearly 5% of the plants to this infection was estimated.

Southern blight (Sclerotium rolfsii) was found in several plantings throughout the State during 1943. In 2 plantings a loss of nearly 10% could be attributed to this disease.

Verticillium wilt (Verticillium albo-atrum) was the most widespread disease of pepper in Arkansas during 1943. Affected fields were observed in several localities in which the causal organism was Verticillium albo-atrum. Losses due to this disease fluctuated from a trace in some plantings to 35% in the most severely affected field.

CITRULLUS VULGARIS, WATERMELON. Fruits affected by anthracnose (Colletotrichum lagenarium) were found in two or three plantings in the State. In one planting a loss of nearly 5% could be attributed to this disease.

Blossom-end rot (non-parasitic) was found without any trouble in all of the plantings surveyed. Commercial plantings as well as home garden plantings were infected and many fruits were lost. Many secondary organisms, such as Rhizopus, Penicillium, Aspergillus, etc., were observed in the primary injury caused by blossom end rot.

Wilt (Fusarium oxysporum f. niveum) (F. bulbigenum var. niveum) was observed in but a single planting in Arkansas during the 1943 season. In this particular planting a susceptible variety was seeded.. The loss, however, was less than 5% in a planting of 125 acres.

CUCUMIS MELO, CANTALOUP. Leaf blight (Alternaria cucumerina) (Macrosporium cucumerinum) was present in all of the plantings surveyed. While it probably was the most serious disease of cantaloup seen during the past season, the extent of injury was very light as the extreme drought prevented the spread of the disease, although the primary infection was widespread. The most severely attacked planting had a loss of over 15% of the foliage due to necrotic areas.

Downy mildew (Pseudoperonospora cubensis) was found on the older leaves of a few plants but was causing very little injury. Early infections were observed in 2 plantings but due to the adverse weather conditions the primary infections failed to develop further.

Bacterial wilt (Erwinia tracheiphila), as observed during 1943, was limited to 3 plants in a small planting of less than an acre.

IPOMOEA BATATAS, SWEETPOTATO. Black rot (Endoconidiophora (Ceratostomella) fimbriata) of sweetpotatoes was observed in only 3 plantings in southern Arkansas. The loss in each of these plantings was less than 1%.

The most prevalent and widespread disease of sweetpotato in Arkansas during the 1943 season was Fusarium stem rot, (Fusarium oxysporum f. batatas)(F. bulbigenum var. batatatis). In commercial plantings the losses fluctuated from a trace up to 15%. In one small home planting a loss of nearly 40% was observed.

A loss of 10% was attributed to leaf spot (Phyllosticta batatas) in one planting consisting of 75 acres. Most of the plants in this planting were infected.

LYCOPERSICON ESCULENTUM, TOMATO. (Fusarium oxysporum f. lycopersici) (F bulbigenum var. lycopersici) was found to be fairly widespread in the State, causing losses fluctuating from 10 to 25%.

Leaf spot (Septoria lycopersici) was present in most of the plantings surveyed, especially in the northwestern part of the State. Severe defoliation occurred in the early part of the season; however, owing to the adverse summer weather conditions, late infections were prevented.

Rootknot (Heterodera marioni) was found in several plantings in northwe Arkansas, the loss in this area ranging from 2 up to 20%. In a commercial planting near Summers rootknot nematode affected 20% of the plants in a 50-acre planting.

Tomato mosaic (virus) was widespread in Arkansas but caused very little damage. In all of the plantings examined but one, infection was limited to only a few plants. In the most severely attacked planting 22 plants were infected with mosaic in a 2-acre planting.

Drouth injury and sun scald (non-parasitic) were the cause of the greatest losses to the tomato industry in Arkansas during the 1943 season. In some fields sun scald was much more abundant than blossom-end rot and resulted in discarding fully 50% of the picking. (H. R. Rosen).

Blossom-end rot (non-parasitic) was extremely prevalent and widespread during the 1943 season in Arkansas. Examples of this condition were foun in nearly every planting surveyed. In some fields as much as 25 to 35% of the picking had to be discarded due to blossom-end rot.

PHASEOLUS VULGARIS, BEAN. Anthracnose (Colletotrichum lindemuthianum) was very prevalent on the first snap bean crop where Michigan-grown seed was planted. Losses of from 75 to 100% of the crop were not at all uncommon. No losses were observed in those plantings in which the seed used w western-grown. (J. R. Shay)

Leaf spot (Cercospora sp. presumably cruenta) was observed in 2 or 3 plantings. Very little loss resulted from these infections other than a slight reduction in the leaf area.

Powdery mildew (Erysiphe polygoni), which has frequently been serious o the late bean crop, was not reported this year, possibly because there wa almost no late crop owing to dry weather. (V. H. Young).

Wilted bean plants (Fusarium sp.) was observed in 2 plantings in northe Arkansas. The amount of loss due to these infections was less than 1%, although wilted plants were not difficult to find in either planting.

Several dead plants revealed sclerotia of Sclerotium bataticola, howeve none of the plants was lodged.

Bean rust (Uromyces phaseoli var. typica) (U. appendiculatus) was seen in a garden in Fayetteville on climbing beans. It was apparently of no importance during the 1943 season. (V. H. Young)

A 100% bean mosaic (virus) infection was observed in a 40-acre planting in southwest Arkansas during the past season.

SOLANUM MELONGENA, EGGPLANT. Wilted plants were collected from 2 plantings during the past season and Fusarium was isolated from their vascular systems. In the most severe case a loss of nearly 15% of the plants resulted in a 3 1/2 acre planting. Southern blight (Sclerotium rolfsii) was observed causing a loss of nearly 15% in one planting.

CEREALS AND FORAGE CROPS

MEDICAGO SATIVA, ALFALFA. Leaf spot (Pseudopeziza medicaginis) was difficult to locate. Specimens were found in plantings in northeastern Arkansas; however, very little loss resulted from these infections.

Rust (Uromyces striatus var. medicaginis) was observed in several plantings in northeastern and southwestern Arkansas. In the planting most severely attacked a loss of 5 to 10% was observed.

ORYZA SATIVA, RICE. Cercospora leaf spot (Cercospora oryzae), was the most prevalent and widespread leaf spot on rice in Arkansas during the 1943 season. Injury to affected plants was confined primarily to the reduction of leaf area. A marked difference in varietal susceptibility of the varieties grown commercially in Arkansas was observed. In 2 or 3 plantings of Blue Rose and Zenith varieties losses of 40 to 60% of the photosynthetic area were attributed to this leaf spot. Nira and Arkansas Fortuna varieties were resistant.

Leaf smut (Entyloma oryzae) was not very prevalent during 1943 in Arkansas; however in one planting a loss of nearly 1% could be attributed to this disease. Kamrose, Prolific, and Zenith varieties were observed affected by leaf smut.

Brown spot (Helminthosporium oryzae) was found in most of the plantings surveyed. In most instances, however, only a few spots were apparent on the leaves and glumes. The amount of damage in most plantings was negligible. In plantings in new rice areas where susceptible varieties were seeded moderate infections with losses from 3 to 5% were observed. The greatest loss was observed where black rice infected with brown spot contaminated a planting of the variety Prolific.

Stem rot (Leptosphaeria salvinii) was not very serious in most of the plantings; however, in 2 plantings, in fields that had been seeded to rice for 3 or 4 years in succession, losses of nearly 5% were observed. In several crosses in the nursery plantings in Arkansas losses were greater than 10%.

Blast (Piricularia oryzae) was limited to plantings in new rice land and where susceptible varieties were seeded. Losses of nearly 20% were observed in areas where rice had been planted for the first time. Three varieties, Prolific, Blue Rose, and Lady Wright, were observed with typical symptoms on the leaves and heads.

White tip (non-infectious) is still prevalent in the rice growing regions of Arkansas; although most of the rice growers are planting varieties that are less susceptible to this condition. One field of the variety Blue Rose revealed white tip to such a degree that a loss of 10% was estimated.

Straighthead (non-infectious) was one of the most serious maladies of rice

in Arkansas during the 1943 season. In 2 plantings nearly 50% of the estimated yield was lost due to this condition.

Sun scald (non-infectious) was observed in 2 large plantings during the 1943 season. The characteristic symptom, white heads devoid of kernels, was observed with an estimated loss of nearly 50% in each of the plantings.

SOJA MAX, SOYBEAN. Frog-eye leaf spot (Cercospora sojina) was found in 3 plantings and present only as a few spots in each instance, and the amount of loss was negligible.

Pod and stem blight (Diaporthe phaseoli var. sojae) was widespread in Arkansas during 1943, and considerable damage was done in certain plantings. A loss of nearly 2% could be attributed to this fungus in 3 of the affected plantings.

Loss due to wilt (Fusarium oxysporum f. tracheiphilum) (F. bulbigenum var. tracheiphilum) never exceeded 1%, although it was not difficult to locate wilted plants in several of the plantings surveyed.

Anthracnose (Glomerella glycines) was observed causing slight damage to nursery plantings, but the disease was observed in only a single commercial planting where the loss was negligible.

Downy mildew (Peronospora manshurica) was found on a few leaves in 2 plantings during the past season. Very little loss could be attributed to this disease as only a few leaves were found infected within a single variety.

Lodging due to charcoal rot (Sclerotium bataticola) was observed on early maturing varieties. In no instance, however, was the loss greater than 1%. Late-maturing varieties were showing symptoms of charcoal rot but lodging had not occurred at the time of the last survey of the season.

Infections of bacterial blight (Pseudomonas glycines) were observed during the 1943 season. In many plantings moderate to severe defoliation occurred as a result of blight infections in combination with the pustule disease. In degree of distribution and prevalence, blight was less than the bacterial pustule disease in Arkansas during the 1943 season.

Bacterial pustule (Xanthomonas phaseoli var. sojense) was the most widespread and prevalent disease of soybean in Arkansas during the 1943 season. In 3 or 4 plantings severe defoliation resulted. There was very little difference in susceptibility of the various varieties grown commercially in Arkansas, although onelate planting of the variety Ogden was relatively free from the disease.

In nursery plantings throughout the State large numbers of plants of several varieties were attacked by mosaic (virus). In one variety in the nursery planting at Clarksdale, all of the plants were attacked. Affected soybean plants were observed in most of the commercial plantings surveyed; however, the loss was negligible.

SORGHUM VULGARE, SORGHUM. Milo disease (Pythium arrhenomanes) was observed in several plantings, but causing no loss greater than 1%. Susceptible varieties were grown in all of the plantings where loss was sustained.

Covered kernel smut (Sphacelotheca sorghi), as observed in 1943, was limited to 2 plantings and was very sparse in development. In one of the plantings a loss of less than 1% could be attributed to it. Only a few heads were found infected in the other plantings.

Bacterial spot (Pseudomonas syringae) and bacterial streak (Xanthomonas

holcicola), were observed in nearly all of the plantings surveyed. The amount of damage inflicted by these bacterial diseases was negligible, although in some plantings they were widespread. Lodging due to the charcoal rot fungus (Sclerotium bataticola) was observed in early maturing varieties. A loss of less than 2% could be attributed to this fungus. Most of the sorghum, however, had been planted since the early floods and had not matured at the time of the last survey of the 1943 season.

VIGNA SINENSIS, COWPEA. Leaf spot (Cercospora cruenta) was prevalent and widespread during the 1943 season in Arkansas. In most of the plantings moderate to severe infections were observed. In one planting the photosynthetic surface was reduced nearly 60%. Severe defoliation occurred on the variety Big Blackeye early in the season; however, in most of the plantings defoliation was too late to cause a great deal of loss.

Wilt (Fusarium oxysporum f. tracheiphilum) (F. bulbigenum var. tracheiphilum) was observed in 3 plantings where susceptible varieties had been seeded. Losses in these plantings were estimated at nearly 3%.

Charcoal rot or lodging (Macrophomina phaseoli). The pycnidial stage, Macrophomina phaseoli, was very prevalent on cowpeas during the 1943 season. The only variety to show any apparent resistance to the disease was the variety Iron. Considerable loss resulted from the infections due to this fungus, in commercial plantings up to 5% and in small variety plantings in nurseries as high as 30%.

Bacterial canker (Pseudomonas syringae)[1] was observed in 4 areas during 1943. Losses fluctuated from a trace up to 5%. In none of the areas was infection as severe as that observed in Oklahoma.

Leaf and pod blight (Xanthomonas phaseoli) [? Pseudomonas syringae][2] was limited to a few plants in 2 plantings; the loss was negligible.

Plants infected with mosaic (virus) were observed in one small planting. Very little loss resulted.

ZEA MAYS, FIELD CORN. Ear rots (Diplodia zeae, Fusarium moniliforme, and Gibberella sp.), were found in some degree in all of the plantings surveyed. Losses varied from a trace in some plantings to 2 or 3% in the most severely attacked plantings. Diplodia and Fusarium infections were found in plantings scattered throughout the State; whereas Gibberella was observed in the area near Clarksdale, Examples of stalk rot caused by Diplodia zeae were observed late in the 1943 season at Fayetteville.

Leaf spot (Helminthosporium turcicum) was found quite frequently during the 1943 season. The amount of damage was negligible in all of the infected plantings.

A leaf spot infection was observed in which the associated Helmintho-

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[1] [Burkholder describes the organism causing a similar disease of cowpeas in Texas as Xanthomonas vignicola n. sp. (Phytopath. 34: 430-432. Apr. 1944). See also Hoffmaster (Phytopath. 34: 439-441. Apr. 1944)].

[2] [Burkholder (l. c.) states that he has not been able to obtain infection of cowpeas in inoculations with X. phaseoli].

sporium sp. did not resemble closely the species usually reported attacking corn.

Root injury (Pythium sp.), resembling very closely the symptoms characteristic of the milo disease of sorghum, was observed causing losses in 3 or 4 plantings.

Brown spot (Physoderma zeae-maydis) was observed in all of plantings surveyed in the southern section of the State. In various plantings a reduction in leaf area up to 5% could be attributed to the causal fungus.

Corn rust (Puccinia sorghi) was not severe and was more or less limited in its distribution during 1943. Infections were observed in northwestern Arkansas where the extent of damage was very slight. In no instance was the leaf area reduced more than 1%.

Corn smut (Ustilago maydis) (U. zeae) was general in its distribution throughout each planting. The extent of the injury fluctuated very little in the fields observed, infection usually resulting in a loss of approximately 5%.

Charcoal rot (Sclerotium bataticola) was present and observed in some degree in all plantings surveyed, especially in early maturing plantings. Losses fluctuated from 1 to 10%. Characteristic infection of bacterial wilt (Bacterium stewartii) was found in one planting during 1943. The damage was less than 1%. The insect vector was present in large numbers in this planting.

FRUIT CROPS

AMYGDALUS PERSICA, PEACH. Peach scab (Cladosporium carpophilum). As a result of the late severe freeze (March 3) in Arkansas very few peach fruits of the early varieties were set. Therefore, an extensive estimatio of the loss due to scab on the varieties could not be determined. Foliage infections were quite prevalent throughout the State with the exception of well-sprayed orchards in the Crowley Ridge area. Fruits on late maturing varieties afforded a good source of examples of peach scab. A loss of nearly 2% of the fruit in orchards near Hope could be attributed to scab; however, only the primary stages of the disease were apparent, no cracking or coalescing of the spots on the fruit being evident. In the experimenta orchards at Hope most of the fruits were attacked by the scab fungus and showed primary and secondary stages of the disease.

Brown rot (Monilinia (Sclerotinia) fructicola) was prevalent on fruits still clinging to the trees at Hope, and the mummies present on the trees as well as on the ground revealed that infection in this region had been fairly heavy. Indications of brown rot were present in the large orchards on Crowley's Ridge; however, the marketable fruit had been harvested.

Bacterial spot (Xanthomonas pruni) was one of the most common diseases of peach during the past season. Most of the trees in the severely infected areas were defoliated to the extent that 9/10 of their leaves had dropped. Fruit infections were apparent in several regions of the State.

FRAGARIA spp., STRAWBERRY. Drought injury was the cause of severe losse of strawberry plants in most of the strawberry plantings in the State. A loss of nearly 100% of the plants in several plantings in White County was observed.

Examples of leaf scorch (Dendrophoma obscurans) were observed in 2 plantings in White County. The amount of damage done by these infections was negligible.

Leaf spot (Mycosphaerella fragariae) was prevalent in two or three plantings in White County. A loss of 10% of the leaf area, due to necrotic spots, was observed. Only a few plants were observed and collected revealing characteristic symptoms and signs of the red-stele disease (Phytophthora fragariae). The infections were limited to 2 small garden plantings and the disease was not found in the commercial plant-growing area of the State.

MALUS SYLVESTRIS, APPLE. Sooty blotch (Gloeodes pomigena) was present in several orchards observed during the past season. Very little damage resulted from these infections other than as a grading factor.

The most serious outbreak of apple cedar rust (Gymnosporangium juniperi-virginianae), was observed in northwest Arkansas, where an orchard of over 40 acres showed a foliage infection of 20%. Fruit infection was apparent on approximately 2% of the fruits. Light to moderate defoliation was observed in one orchard in northwest Arkansas.

Fly speck (Leptothyrium pomi) was apparent in orchards in northwest Arkansas. Very little loss could be attributed to this disease, although examples could be located without too much difficulty. In neglected orchards infection was comparable in extent to that usual for sooty blotch.

Apple blotch (Phyllosticta solitaria) was severe on early maturing susceptible varieties not properly sprayed. The foliage of Yellow Transparent variety was heavily infected. Observation of blotch on fruit of susceptible varieties was limited to a few fruits. Dry, hot weather reduced the infections on late maturing varieties; however, blotch was found on several susceptible varieties causing a loss of nearly 2%.

Black rot (Physalospora obtusa) was one of the most serious diseases of unsprayed apples observed in Arkansas during the 1943 season. In such orchards losses of 5 to 15% were estimated. Characteristic frog-eye leaf spots were apparent in most of the orchards surveyed, as well as fruit and twig infections.

Brown rot (Monilinia (Sclerotinia) fructicola), in most instances, was associated with injury to the fruit, either mechanical or insect injury. Loss was negligible.

Apple scab (Venturia inaequalis) was still noticeable in well-sprayed orchards throughout the State; however, losses of less than 5% were estimated. Infections fluctuated from a trace to 20%.

Fireblight (Erwinia amylovora) was light in most of the regions surveyed. In one locality the infection could be considered moderate.

PRUNUS spp., CHERRY. Leaf spot (Coccomyces hiemalis) was the only disease observed on cherries in Arkansas during the 1943 season. The extent of the loss was less than 5%. In one orchard in northwest Arkansas slight defoliation resulted.

RUBUS spp., CANE FRUITS. Anthracnose (Elsinoë veneta) was well established in plantings scattered throughout the blackberry-growing region of the State. The most severe infections were located in the northwest section. The losses fluctuated from 5 to 10% in most of the plantings.

Orange rust (Gymnoconia peckiana) is one of our most serious blackberry

diseases which causes moderate losses but is not in evidence late in the season. It was very prevalent early in the 1943 growing season. (V. H. Young).

Leaf spot (Septoria rubi) was severe enough in many plantings to cause moderate defoliation. In 2 plantings a loss of nearly 15% of the foliage area resulted.

VITIS spp., GRAPE. Black rot (Guignardia bidwellii) was of considerable importance. Weather conditions in May and early June favored it and continued rains prevented proper timing of sprays. The situation would have been much worse if normal rainfall had continued into July. (V. H. Young).

In several of the plantings scattered throughout the grape growing region, black rot infections were not at all uncommon. Leaf and fruit infections were observed in nearly all of the plantings surveyed. Estimated losses ranged from 5 to 25%, and in one planting to nearly 50%.

Downy mildew (Plasmopara viticola) was limited in its distribution, as observed during the 1943 season. Primary infections were observed in several plantings, but further development of the disease was prevented by the adverse weather conditions. Downy mildew was observed on a few leaves in one planting, late in the season.

SPECIAL CROPS

ARACHIS HYPOGAEA, PEANUT. Leaf spot (Cercospora arachidicola and Cercospora personata) was found in most of the plantings scattered throughout the State. In plantings near Ozark, in the Arkansas River "bottom land" leaf spot infections were observed causing considerable defoliation. Both species of Cercospora were present in this area. Other plantings throughout the State showed fewer infections. The peanut crop was planted too late and had made little growth when dry weather set in and finally gave very low yields. Leaf spot failed to develop except in very favorable places and actually caused little injury over most of the State.

Specimens of peanuts with stems attacked by a pycnidial fungus were collected near Parkin. Culture studies revealed that the causal organism was Diplodia frumenti. Loss due to this fungus in the infected area was nearly 5%.

Specimens of peanuts infected by a root rotting fungus were collected in late July and early August. While microscopic and culture studies suggested that the infections were due to Rhizoctonia it is probable that Sclerotium rolfsii was the primary cause of this disease. Very little loss could be attributed to these infections. Specimens of dead peanut plants collected in the same field, late in the growing season, by Professor Young and sent to Dr. B. B. Higgins of the Georgia Experiment Station, were identified by the latter as southern blight.

GOSSYPIUM HIRSUTUM, COTTON. The outstanding features of the cotton disease situation were (1) delay in emergence and planting from early drouth; (2) serious losses in stands from floods, washing, wet-spots, and damping-off; (3) serious nematode injury in sandy soils; (4) less Fusarium wilt than usual, owing apparently to hot, dry weather. We have noted this in previous drouth years; (5) less angular leaf spot, anthracnose on bolls,

and other boll injury, owing to dry weather; (6) very serious injury from drouth and deficiency troubles. (V. H. Young).

Leaf spot (Alternaria sp.) was widespread and very prevalent during the past season in Arkansas. Leaves infected by this fungus were apparent in early August, suggesting that some loss may be attributed to this disease. Alternaria infections were primary in many instances and in several cases secondary in nature.

Leaf spot (Cercospora sp.) was extremely prevalent and widespread during the 1943 season. Moderate to severe defoliation occurred early in August. Cercospora leaf spot, as observed this season, may have caused some reduction in the yield of cotton; however, in most seasons defoliation due to Cercospora leaf spot occurs late and has very little, if any, effect on yield. According to Dr. Young late summer leaf spots in Arkansas are, regardless of the fungi present, only secondary to non-parasitic troubles, i.e., drought injury, potash deficiency, and probably other deficiencies in some cases, and would be of minor importance if adverse soil or weather conditions were not present.

Wilt (Fusarium oxysporum f. vasinfectum) (F. vasinfectum) was observed in 20 counties in Arkansas during the 1943 season. This is not to suggest that cotton wilt is limited to these counties in Arkansas, but merely means that plantings in these counties were observed and found to be infected with this disease. The infections varied from 1% to nearly 30% in the most severely attacked plantings.

Root rot (Phymatotrichum omnivorum) had previously been reported from a very limited area in Little River County. Root rot was observed on "black land" west and south of Foreman, Arkansas. The observed distribution during the past season included scattered specimens from Foreman southwest into southeastern Oklahoma. The degree of damage sustained in various plantings fluctuated from 2 to over 10% depending upon the location of the planting. The most severe infection was observed in the lowland southwest of Foreman.

Wilt (Verticillium albo-atrum) was observed in 5 plantings scattered through the State; always, however, associated with heavy alkaline soil. The loss due to Verticillium wilt was far less than from Fusarium wilt. The amount of loss fluctuated from a trace in one planting to nearly 3% in the most severely infected planting.

Angular leaf spot (Xanthomonas malvacearum) was observed in some degree in many of the plantings surveyed. In one or two plantings in southwestern Arkansas slight defoliation resulted from early infections. Although abundance of inoculum was present early in the season, late infections were difficult to find, owing to adverse weather conditions prevailing during most of the growing season.

Primary infections of bolls due to this bacterium were difficult to locate. Very few infected bolls were found.

Rootknot (Heterodera marioni) was observed causing some damage in northeast Arkansas. A loss of nearly 1% could be attributed to rootknot in 2 plantings near Newport.

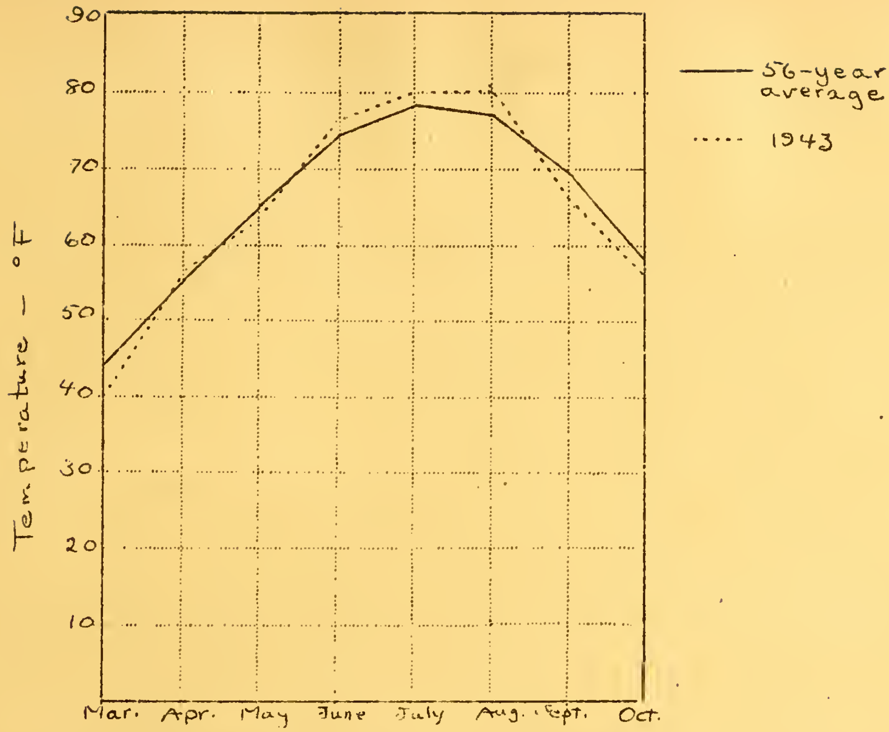
Rust (potassium deficiency). Cotton plants were observed in several plantings showing signs of potassium hunger during 1943.

SUMMARY OF PLANT DISEASES OBSERVED IN MISSOURI DURING 1943

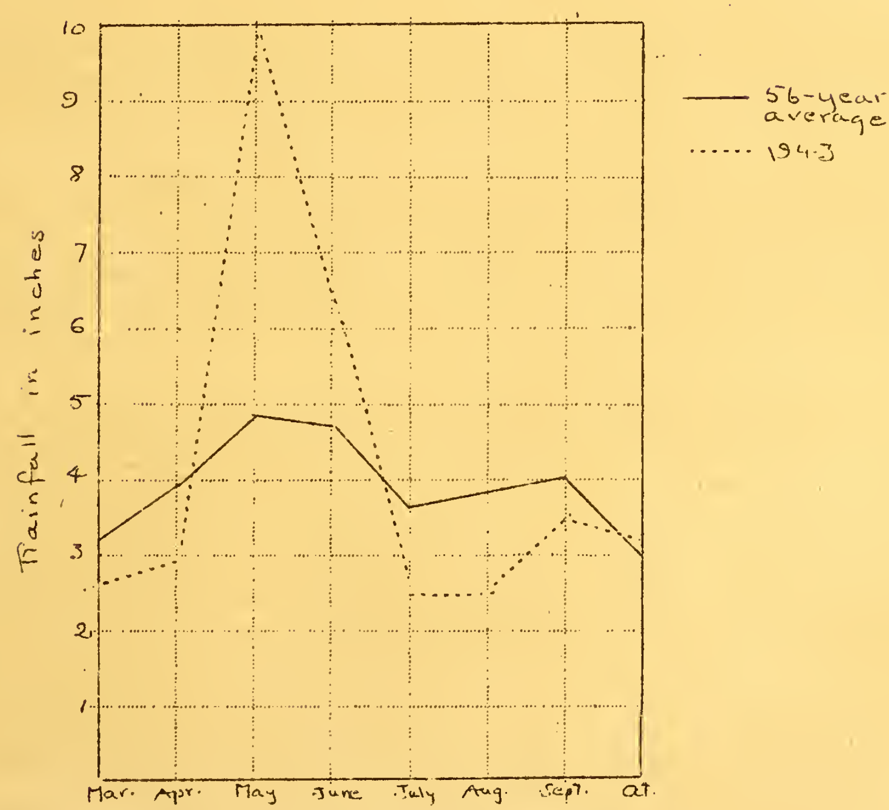
T. W. Bretz

The following summary of estimates on the plant disease losses in Missouri for the year 1943 is based on the rather limited observation of the writer, supplemented by the observations of Dr. C. M. Tucker, Department of Botany, W. R. Martin and J. W. C. Anderson, Extension Specialists in Horticulture, of the University of Missouri, and Ivar Twilde of Jefferson City, Missouri, in charge of Barberry Eradication in this State. In general it has not been possible to report the trend of the plant disease situation during the growing season, nor the relative severity of the various diseases in the different sections of the State, owing to the late start of the Emergency Plant Disease Prevention Project and the limited time spent in the different areas.

The weather was unusual in several respects during the growing season. The severe temperatures and frequent frosts during March and April were, in general, very damaging to the fruit trees, except in the case of apples. The wettest May on record occurred in 1943. Rains began on May 6 and occurred almost daily until the 21st, after which intermittent showers fell at frequent intervals until the close of the month. Monthly amounts were generally heavy to excessive, particularly over a wide belt extending diagonally across the State from the southwestern corner to the east-central boundary. Corn and other cultivated crops suffered generally from too much moisture and lack of cultivation. In general all crops on bottom land along the larger streams where flood conditions prevailed were severely damaged. June was warm and wet over much of the State, further delaying the planting and cultivation of crops. High water in the major streams prevailed throughout most of the month and lowlands remained inundated in most sections. The last week in June afforded the first opportunity to get into fields since the last week of May. During July, precipitation was deficient in the southeastern and southwestern divisions of the State and drought conditions prevailed during the latter half of the month, particularly in the southwest. August was, in general, hot and dry, with severe drought prevailing in the southern and southwestern sections. Except in some south-central areas where severe drought continued, conditions of the preceding months were generally relieved during September and there was some recovery of crops from the effects of the dry spell. Subnormal temperatures prevailed generally throughout September. The growing season ended at about the average date for the northern and central sections of the State, but about one to two weeks earlier than the average in the southern sections, with killing frosts and freezing temperatures about the middle of October.



Missouri - State Average Temperature



Missouri - State Average Rainfall

VEGETABLE CROPS

ALLIUM CEPA, ONION. This is not a crop of commercial importance in the State and its culture is almost wholly confined to home gardens. Botrytis allii (neck rot) appeared to be the only disease of importance and was estimated to have been responsible for only a trace of damage.

CUCUMIS SATIVUS, CUCUMBER. The culture of cucumber is for the most part limited to the home garden, although there is limited production under glass in the Kansas City area and in truck gardens in this area and near St. Louis. Erwinia tracheiphila, bacterial wilt, was undoubtedly the most important disease encountered and probably accounted for a 20% reduction in yield. Mosaic (virus) was considered to be of minor importance and responsible for a trace of damage.

LYCOPERSICON ESCULENTUM, TOMATO. Tomatoes are grown on a commercial scale in various sections of the State, both in the field and under glass. Field grown tomatoes were adversely affected by the weather in the southwestern area where the extended drought and diseases caused a probable 60% reduction in yield. In the northern counties, the frequent precipitation throughout the growing season accounted for a general increase of fruit rots and Septoria blight as compared with their prevalence in the average season.

Alternaria solani, early blight, was observed affecting the foliage in a number of plantings, but the stem lesions were noticeably less common than in some years. Damage from this disease was considered minor, amounting to no more than a trace.

Colletotrichum phomoides, anthracnose, did not appear to be a serious problem except in a few isolated instances late in the growing season. For the State as a whole, a trace of damage could be attributed to this disease.

Corynebacterium michiganense, bacterial canker, was observed in only a few instances on southern-grown stock and, in general, was considered to be of minor importance, causing a trace of damage.

Fusarium oxysporum f. lycopersici (F. bulbigenum var. lycopersici), wilt, continues to be an important problem, particularly where wilt-susceptible varieties are grown for commercial processing. It was estimated that a 50% loss resulted from wilt infection.

Septoria lycopersici, Septoria blight, was prevalent and serious in all sections of the State, causing much defoliation by mid-summer. The yield of the early pickings was probably not greatly reduced, except in that much of the fruit set was lost as a result of severe sunscald. Subsequent pickings were noticeably short, however, and of inferior quality. It was estimated that 15% of the crop was lost because of this disease.

Xanthomonas (Phytomonas) vesicatoria, bacterial spot, was prevalent in practically all fields, ranging from a trace to as much as 25% of the fruit affected. It was decidedly more prevalent in the northern, more moist counties. The bacterial lesions themselves do not seriously affect fruit used for processing, but undoubtedly they provide avenues of entrance for secondary, rot-producing organisms. A probable loss of 3% was estimated to have resulted from this disease.

Heterodora marioni, rootknot, was of importance in local situations,

particularly in the southern section, and it appeared occasionally in northern counties on southern grown planting stock. For the entire State, the damage resulting was considered to be of minor importance, amounting to a trace.

Fruit rots caused by various secondary organisms following sunscald, growth cracks, insect injuries, etc. were responsible for much loss throughout the season in all sections, accounting for an estimated 15% reduction in yield.

Mosaic (virus) was observed in a few instances but in no case was it a serious problem. Probable damage amounted to a trace.

Greenhouse-grown tomatoes are subject to certain diseases which do not, ordinarily, become problems in the field.

Cladosporium fulvum, leaf mold, is undoubtedly the most serious problem encountered in the culture of tomatoes under glass. It was estimated that this disease accounted for a 15% reduction in yield.

Despite a somewhat better opportunity to control Fusarium wilt under greenhouse conditions than is possible in the field, it was estimated to have caused a loss of 5% in the greenhouse tomato yield.

Phytophthora parasitica, buckeye rot, is of considerable importance as a factor in tomato production under glass. It was estimated to have caused a 4% loss.

Sclerotium sclerotiorum, drop, becomes of major importance in certain houses from time to time and may seriously affect production. On the average, however, the probable loss amounted to no more than 1% this past season.

Blossom-end rot, (physiogenic), is not uncommon in greenhouse tomato plantings and it was estimated to have caused a 2% reduction in yield.

PHASEOLUS VULGARIS, BEAN. The production of green snap beans is limited almost entirely to the home garden, although more extensive production occurs to some extent in truck gardens near the metropolitan centers.

Fusarium solani f. phaseoli (F. martii var. phaseoli), dry root rot, was observed but considered to be of minor importance, causing a trace of damage. Xanthomonas (Phytomonas) phaseoli, bacterial blight, was unquestionably the most serious disease problem on this crop, reducing the yield an estimated 20%. Uromyces phaseoli var. typica, rust, was of minor importance, responsible for only a trace of damage. Heterodora marioni, rootknot, was important in localized situations in reducing yield, but for the entire State, was considered to have reduced the yield only a trace. Mosaic (virus) was observed but considered to be of little importance, causing a trace of damage.

SOLANUM TUBEROSUM, POTATO. The most important commercial potato producing area in the State is located near Kansas City on low-lands, which were inundated during the spring floods. It was estimated that fully 50% of the crop was lost, either in the field or indirectly because of tuber decay in transit, as a result of the standing water. The loss due to other factors was of minor importance.

Actinomyces scabies, scab, was considered to be of little importance, accounting for a trace of damage. Erwinia phytophthora (E. carotovora), blackleg, was estimated to have caused a 1.0% loss, as was Fusarium solani f. eumartii (Fusarium wilt). Rhizoctonia solani, black scurf, was estimated to have caused a trace of damage.

CEREALS AND FORAGE CROPS

AVENA SATIVA, OATS. Erysiphe graminis, powdery mildew, was considered to be of minor importance and responsible for a trace of damage. Fusarium sp. and Pythium spp., caused root necrosis, a serious and prevalent trouble resulting in an estimated 5% reduction in yield. Puccinia coronata, crown rust, was prevalent in all fields but according to the State Barberry Eradication Office, was of minor importance as a factor in reducing yield. A trace of damage was attributed to it. Puccinia graminis, stem rust, was quite prevalent and in some instances severe damage resulted. The State Barberry Eradication Office reported an estimated reduction in yield of 0.5% for the State. Ustilago avenae (loose smut) and U. kolleri (U. levis) (covered smut) caused a combined loss estimated at 7% of the yield.

HORDEUM VULGARE, BARLEY. Erysiphe graminis, powdery mildew, was of minor importance and caused only a trace of damage. Gibberella zeae (G. saubinetii), scab, was prevalent and caused an estimated 2% reduction in yield. Helminthosporium sp., Fusarium sp., and Ophiobolus graminis were associated with foot rot, which was of minor importance and was estimated to have caused a trace of damage.

Helminthosporium gramineum, stripe, was responsible for a loss amounting to a trace. Helminthosporium sativum, spot blotch, was somewhat more prevalent and serious than in average years, causing an estimated 5% reduction in yield.

Puccinia anomala, leaf rust, was prevalent in all sections of the State, but only a trace of damage was thought to have resulted from the disease, according to the State Barberry Eradication Office. Puccinia graminis, stem rust, was observed in only a small percentage of fields and was considered to be of no importance in reducing the yield. No loss was reported by the State Barberry Eradication Office.

Pythium spp., root necrosis, was a serious problem and was responsible for an estimated 10% reduction in yield.

Rhynchosporium secalis, leaf scald, was of minor importance and caused a trace of damage.

Ustilago jensenii (U. hordei), covered smut, was responsible for an estimated 5% loss. Ustilago nuda and U. intermedia, loose smuts, were estimated to have caused a combined loss amounting to 3%.

MEDICAGO SATIVA, ALFALFA. Pseudopeziza medicaginis (leaf spot) and Pyrenopeziza medicaginis (yellow leaf blotch) are probably the most destructive diseases of alfalfa in this region. They were severe on the first cutting and it was estimated that the yield was reduced 5%.

Rhizoctonia crocorum, violet root rot, was reported to be causing some damage in localized areas, specimens having been sent in to the University from Washington county.

"Crown rot" due to decay following insect damage was observed in the northwestern part of the State, affecting 3 to 5% of the stand in certain fields. It appeared to be a problem only in relatively old stands. The trouble was diagnosed by the Emergency Plant Disease Prevention Laboratory at Stillwater, Oklahoma, as secondary decay following injury by the clover root curculio, Sitona hispidula.

SECALE CEREALE, RYE. Practically all of the rye planted in the State is used as a fall and winter pasture crop and is plowed under in the spring. The diseases which occur are, therefore, considered to be of minor importance, except those influencing stand or affect leaf development.

Claviceps purpurea, ergot, was present to a very limited extent and caused an estimated loss amounting to a trace. Puccinia rubigo-vera var. secalis (P. dispersa), leaf rust, was considered to be of minor importance, causing a trace of damage. Pythium spp., root necrosis, was the most serious disease problem, causing an estimated 5% loss. Ustilago sp. caused a probable trace of damage.

SOJA MAX, SOYBEAN. A number of diseases were observed on soybeans. Except in individual fields, none of the diseases was considered to be particularly destructive and there seemed to be no apparent differences in their prevalence in the various sections of the State.

Diaporthe sojae, pod and stem blight, was observed in approximately 1/5 of the fields examined. In no instance was it destructive and it was estimated to have been responsible for only a trace of damage.

Peronospora manshurica, downy mildew, was observed in about half of the fields late in the growing season. Since the disease apparently did not become established until the plants were quite fully developed and the lesions were in the early stages of development, probably no more than a trace of damage resulted from the infections.

Pseudomonas (Phytomonas) glycinea (bacterial blight) and Xanthomonas (Phytomonas) phaseoli var. sojense (bacterial pustule), were present in practically every field, but in varying amounts. Infection ranged from instances in which only a few of the lower leaves were involved to situations where 100% of the foliage showed the presence of lesions. In no case were these diseases considered to be responsible for a great deal of damage, in that the total leaf area involved was rather small. It was estimated that the probable reduction in yield amounted to about 3%.

Macrophomina phaseoli [? sclerotial stage], charcoal rot, was observed affecting plants in only one field in southeastern Missouri, accounting for a 3 to 5% kill. For the State, the damage would amount to no more than a trace.

Bud blight (virus ?) was prevalent in approximately 2/3 of the fields examined. Its extent varied from field to field. In many, only a few scattered plants showed the characteristic symptoms; in others, practically all plants showed evidence of infection. In only a limited number of fields was infection severe enough to have caused an appreciable reduction in yield and it was estimated that for the State, no more than a 1% loss could be attributed to the disease.

TRITICUM AESTIVUM, WHEAT. Gibberella zeae (G. saubinetii), scab, was prevalent and caused an extimated 2% loss.

Puccinia graminis, stem rust, varied in prevalence depending upon locality and the variety of wheat grown, but in general it was not a serious problem. It was estimated to have caused a trace of damage for the entire State, according to the State Barberry Eradication Office.

Puccinia rubigo-vera var. tritici (P. triticina), leaf rust, was prevalent in all localities, but the losses resulting were considered to be negligible, according to the State Barberry Eradication Office. A trace of damage was reported.

Pythium spp., root necrosis, was one of the most serious disease problems, accounting for an estimated 10% reduction in yield.

Septoria tritici, speckled leaf blotch was of minor importance, causing a trace of damage.

Tilletia foetida (T. laevis) and T. caries (T. tritici), bunt, caused an estimated 1% loss.

Ustilago tritici, loose smut, was of considerable importance, causing an estimated 6% reduction in yield.

Xanthomonas (Phytomonas) translucens var. undulosa, black chaff, was of minor importance, causing a trace of damage.

ZEA MAYS, FIELD CORN. Bottom-land corn was subject to frequent and prolonged inundation during the spring rains in much of the State and as a result got off to a very late start. Many fields were replanted and some plantings were made as late as the latter part of June and early July. Bacterial stalk rot (Phytomonas dissolvens) was a problem locally in these excessively moist situations and much of this late planted corn was killed by the October freezes before it had fully matured. In the southwestern section, the severe July and August drought stopped the development of the plants, precluding the possibility of a profitable yield.

Aspergillus spp., ear rot, was relatively common following corn ear-worm damage, but probably caused only a trace of damage.

Diplodia zeae, dry rot, was prevalent in all fields except some very late planted ones in which the plants were still green and immature in late October. The stalk rot phase of the disease varied in prevalence from an average of 11% infection in the southwestern, drought-affected counties to an average of 33% infection in the northern section where more normal precipitation occurred. Only 2% reduction in yield was estimated since most of the plants apparently became infected relatively late and had produced reasonably good ears. The ear rot phase varied little in the different parts of the State and was estimated to have caused a 1% loss.

Fusarium moniliforme, ear rot, was prevalent in all regions, particularly following ear worm damage. Although the percentage of ears infected was fairly high in some fields, the actual loss was estimated to have amounted to 0.5%.

Gibberella zeae (G. saubinetii), ear rot, was likewise prevalent over the State, varying considerably from field to field. The average loss probably amounted to about 0.5%.

Nigrospora oryzae, ear rot. This organism was very prevalent and was found affecting a very high percentage of secondary ears. Since these ears normally do not develop, this infection may be discounted in estimatint the loss due to Nigrospora. The percentage of primary ears affected averaged less than 0.5% and it was estimated that the actual damage resulting amounted to a trace.

Penicillium spp., ear rot, was common following ear worm damage. The loss, however, was estimated to be no more than a trace.

Phytomonas dissolvens, bacterial stalk rot, was important in localized situations on flooded bottom-lands. No more than a trace of damage was noted by the writer, although reports were received at the University indicating that in a few fields a relatively high percentage of plants was affected.

Bacterium (Phytomonas) stewartii, bacterial wilt, was observed but considered to be of minor importance, accounting for a trace of damage.

Puccinia sorghi, rust, was prevalent in all sections of the State but in no instance was it a serious problem. The probable loss was estimated as a trace.

Macrophomina phaseoli [? sclerotial stage], charcoal rot, was observed in only one field in the southwestern part of the State, affecting 4% of the plants. Damage from this disease on a State basis was estimated at a trace.

Ustilago maydis (U. zeae), smut, was common in all areas, the severity of infection varying from field to field. The estimated loss amounted to 2.0%.

Seed and Seedling decay. The exceptionally wet spring weather undoubtedly contributed to much pre-emergence and post-emergence decay by a varied group of organisms. It was estimated that at least 10% loss could be attributed to this complex.

FRUIT CROPS

AMYGDALUS PERSICA, PEACH. It was estimated that the production of peaches in 1943 was only 10 to 15% of normal. This short yield was probably due in the main to the late spring freezes. With the prospects of a short crop, it is thought that orchardists concentrated more than usual in keeping disease losses at a minimum by thorough and timely spraying. As a result, disease losses were somewhat less than might have been expected in a season so favorable for their development.

Cladosporium carpophilum (scab) and Xanthomonas (Phytomonas) pruni (bacterial spot) were considered to be of no more than minor importance and responsible for a trace of damage. Monilinia (Sclerotinia) fructicola, brown rot, was undoubtedly the most serious disease problem again this year, causing an estimated loss of not more than 10%. Taphrina deformans, leaf curl, was thought to be of minor importance, probably causing a trace of damage. Late spring freezes caused an estimated 75 to 80% reduction in yield through damage to fruit buds.

FRAGARIA, STRAWBERRY. No serious disease problems were reported for this crop. Mycosphaerella fragariae, leaf spot, was common and accounted for an estimated 2% reduction in yield. Botrytis spp., Phytophthora cactorum, and Rhizoctonia sp., field fruit rots, were aided by the moist weather and caused an estimated 6% loss.

MALUS SYLVESTRIS, APPLE. Erwinia amylovora, fireblight, was considered a serious problem locally in certain orchards in which adequate precautions for its control were not practiced. For the State as a whole, the disease was considered to be of minor importance.

The State loss in commercial plantings from Glomerella cingulata, bitter rot, was quite low, probably not exceeding 1%. In the southern tier of counties it may cause serious damage, as much as 50% fruit infection having been observed in one orchard . Relatively few commercial plantings are in this area, however.

Gymnosporangium juniperi-virginianae, cedar-apple rust, was prevalent on the foliage of susceptible varieties but only a trace of fruit infection was observed. Probably no more than a trace of damage resulted.

Phyllosticta solitaria, blotch, was considered to be of minor importance and responsible for a trace of damage to the crop as a whole. Moderately

severe infection was observed on certain very susceptible varieties, none of which is grown extensively.

Physalospora obtusa, black rot, on the whole, was considered to have caused a trace of damage, but in localized situations as much as 2% of the fruit was affected.

Venturia inaequalis, scab, was undoubtedly the most serious disease problem over the State. In well sprayed orchards, no more than 8% loss occurred. Losses amounting to 75% or more of the crop occurred in partially sprayed or unsprayed plantings. The State average probably amounted to an 18 to 20% reduction in yield.

Apples suffered less than the other fruit crops from the late spring freezes and in general, the damage amounted to a trace. In certain orchards in the southern section and in localized situations, 6 to 8% of the fruit showed frost banding.

PRUNUS sp., CHERRY. This fruit is of very minor importance commercially. Late spring freezes and leaf spot (Coccomyces hiemalis) were probably the 2 most serious problems affecting fruit production. The few trees observed by the writer in August were almost entirely defoliated by the leaf spot infection. No estimates are available on the probable loss due to these troubles, nor on the other diseases commonly affecting the cherry.

PRUNUS spp., PLUM. Very limited observations by the writer indicated that Xanthomonas (Phytomonas) pruni (bacterial spot) was the disease of major importance on plum. In one orchard the crop was considered a total loss due to fruit infection, despite efforts to control the disease by spraying. In other plantings, heavy foliage infection was common and fruit infection was commonly followed by brown rot Monilinia (Sclerotinia) fructicola). The two diseases combined, probably reduced the yield at least 20%.

VITIS spp., GRAPE. The frequent precipitation during the season necessitated more frequent applications of protectants to control black rot (Guignardia bidwellii) than in the average season. In well sprayed plantings the loss averaged an estimated 10%. In poorly sprayed vineyards losses up to 60% were reported. An average loss for all situations was estimated to amount to 15%.

SPECIAL CROPS

GOSSYPIUM, COTTON. This crop, except in localized situations, seemed to be relatively free from destructive diseases. Fusarium oxysporum f. vasinfectum (wilt), Glomerella gossypii (anthracnose), Xanthomonas (Phytomonas) malvacearum (angular leaf spot), Rhizoctonia solani (seedling blight) and Heterodora marioni (rootknot), were, on the whole, of minor importance, although in isolated instances each was considered to be a major disease problem. A trace of damage was attributed to each on a State basis. "Rust" (potash deficiency), was prevalent throughout the cotton region, but its effect was so variable from field to field and county to county, that no attempt was made to estimate its probable effect on yield.

THE PLANT DISEASE REPORTER

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SUPPLEMENT 149

PLANT DISEASE SURVEYS
IN THE WESTERN UNITED STATES IN 1943

July 1, 1944

PLANT DISEASE SURVEYS

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Plant Disease Reporter
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DISEASES IN NORTH DAKOTA IN 1943[1]

Ian W. Tervet

The crop season of 1943 was very favorable for the growth of all crops, rainfall being abundant throughout the State although somewhat excessive in the south-eastern counties during the earlier part of the growing season. The moist conditions prevailing in the southeastern counties were favorable for the unusually heavy development of pasmo (Mycosphaerella (Sphaerella) linorum) on flax, this disease causing greater loss in 1943 than the usually more destructive rust. Spot blotch (Helminthosporium sativum) and head blight (Helminthosporium spp.) on barley were heavy in the eastern third of the State and caused above average losses. Scab (Gibberella zeae) (G. saubinetii) was most severe on both barley and wheat in the south-eastern counties but was not found west of the Red River Valley. An outbreak of Alternaria solani on potato tubers in 3 localities in the Red River Valley was the most striking disease on potatoes. Late blight was of minor importance in comparison with the losses in 1942.

DISEASES OF VEGETABLE CROPS

BRASSICA OLERACEA var. CAPITATA, CABBAGE. In one small field in McLean County 50% of the plants were killed by black rot (Xanthomonas campestris) (Bacterium campestre). About 1% loss for the State was estimated from bacterial soft rot (Erwinia carotovora).

CUCUMIS MELO, CANTALOUP. Anthracnose (Colletotrichum lagenarium) caused somewhat more loss on cantaloup than is usual, a reduction of about 1% resulting.

LYCOPERSICON ESCULENTUM, TOMATO. Leaf blight (Septoria lycopersici) was present wherever tomatoes were grown. The disease was most severe in the east-central and southeastern sections. Blossom-end rot (physiogenic) occurred generally.

PHASEOLUS VULGARIS, BEAN. Bacterial blight (Xanthomonas phaseoli) caused somewhat higher loss than average, about 4% reduction in yield occurring. Loss from mosaic (virus), about 3%, was similar to that in previous years.

SOLANUM TUBEROSUM, POTATO. Common scab (Actinomyces scabies) was not a severe problem in 1943, serious damage resulting only rarely. Some of the lighter soils in Walsh County had the heaviest infection seen.

A moderate to heavy vine infection by early blight (Alternaria solani) occurred throughout the Red River Valley and reduced yields somewhat. Unusually heavy tuber infections were found in Grand Forks and Walsh Counties.

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[1] The writer expresses his gratitude to Dr. W. E. Brentzel and to Dr. F. Gray Butcher of North Dakota State College for their assistance during the course of the survey.

(Corticium solani) see Pellicularia filamentosa.

Little change occurred in the bacterial ringrot (Corynebacterium sepedonicum) situation in 1943. Loss was light, a relatively few fields only in the Red River Valley being heavily infected.

Blackleg (Erwinia phytophthora) (E. carotovora) was favored by the wet and late season and losses were slightly higher in 1943.

Fusarium wilt (F. oxysporum) was somewhat less evident than in most years.

Black scurf (Pellicularia filamentosa) (Corticium solani) caused much less loss than usual.

Late blight (Phytophthora infestans). The epidemic of late blight in 1943 was much less severe than in 1942. The most severe vine and tuber infections occurred in eastern Traill, Grand Forks, Walsh, and Pembina Counties. Only Ohios were consistently heavily attacked by tuber rot. At Bismarck, potatoes grown on the Missouri River flats were also heavily attacked by late blight, Ohios, Red Warbas, and Triumphs having many infected tubers. This limited section near Bismarck was the only place in North Dakota outside of the eastern counties where late blight did damage.

Some reduction in yield resulted from hopperburn.

A trace of loss from the virus diseases leafroll and mild mosaic was reported.

Purple top wilt (virus) was found generally in the wetter sections of the State, but heaviest infections occurred in the eastern counties.

DISEASES OF CEREALS AND FORAGE CROPS

AVENA SATIVA, OATS. Crown rust (Puccinia coronata) was the most important disease on oats in 1943, causing severe damage in the older susceptible varieties. Stem rust (P. graminis var. avenae), for the State, did no more than a trace of damage, but late-planted fields in the north-central and northwestern parts were heavily infected and suffered some loss. Infection by loose smut (Ustilago avenae) and covered smut (U. kolleri) (U. levis) remained at about the same level as in most recent years, about 1% loss being estimated.

HORDEUM VULGARE, BARLEY. A trace of ergot (Claviceps purpurea) occurred.

Seed from Richland County in southeastern North Dakota contained many kernels infected by scab (Gibberella zeae) (G. saubinetii).

Leaf stripe (Helminthosporium gramineum) is not common and is of slight importance, only a few fields containing infected plants.

Spot blotch (H. sativum) was severe in the eastern third of the State, and caused some reduction in yield. Usually this disease is of much less importance.

Head blight associated with Helminthosporium spp. was common in the eastern third of the State.

A trace of stem rust (Puccinia graminis) occurred, and leaf rust (P. anomala) was present but did little damage.

Loss from the barley smuts, covered smut (Ustilago jensenii) (U. hordei) and loose smut (U. nuda) was a trace; light infections being found generally in the State.

LINUM USITATISSIMUM, FLAX. Wilt (Fusarium oxysporum f. lini) (F. lini) resulted in a trace of loss. Rust (Melampsora lini) was much less severe than in 1942, very little loss resulting in 1943. Bison was attacked most severely, infections being heaviest in the northern counties and on late-planted flax.

Pasmo (Mycosphaerella (Sphaerella) linorum) was responsible for the greatest reduction in flax yield. It was most severe in the southeastern and east-central sections of the State and caused great injury to much of the yellow-seeded flaxes in these areas. Yellow flaxes on the irrigated lands near Williston in western North Dakota were also heavily attacked.

Browning disease (Polyspora lini) caused very little damage, a trace reduction in yield only being recorded.

The cool wet season of 1943 reduced losses from heat canker (nonparasitic) considerably.

MEDICAGO SATIVA, ALFALFA. Leaf spot (Pseudopeziza medicaginis) had a scattered distribution and was somewhat more abundant than in 1942. Winter injury is normally very important but less than average loss occurred in 1943. A loss of about 6% was estimated.

MELILOTUS ALBA, SWEETCLOVER. Black stem (Ascochyta lethalis), a disease of minor importance normally, increased in severity in 1943.

SECALE CEREALE, RYE. Very little ergot (Claviceps purpurea) was seen; and loss from leaf rust (Puccinia rubigo-vera var. secalis) (P. dispersa) was light.

TRITICUM AESTIVUM, WHEAT. Ergot (Claviceps purpurea) infection was limited to a trace.

A relatively heavy infection of scab (Gibberella zeae) (G. saubinetii) was seen in the Red River Valley, but little or none occurred west of the Valley.

The development of root and foot rots associated with Helminthosporium sativum was favored by heavy rains. Some reduction in yield resulted from head blight, especially in the wetter regions of the Red River Valley.

Stem rust (Puccinia graminis var. tritici) caused very little loss in 1943, only light infections occurring. Leaf rust (P. rubigo-vera var. tritici) (P. triticina) resulted in less than average injury.

Bunt (Tilletia foetida (T. levis) and T. caries (T. tritici)) occurred in scattered infections.

Black chaff (Xanthomonas translucens f. sp. undulosa) was severe in the Red River Valley.

Wet weather at harvest caused considerable damage in the Red River Valley.

ZEA MAYS, CORN. Stalk rot caused by Fusarium spp. was less severe than usual. Smut (Ustilago maydis) (U. zeae) caused about 2% reduction in field corn and about 3% in sweet corn.

DISEASES OF MISCELLANEOUS HOSTS

BETA VULGARIS, SUGAR BEET. Cercospora leaf blight (C. beticola) was present in sugar beets in Cass County adjacent to the Red River. Infection was light and developed at the end of August, too late for any appreciable loss to the crop.

FRAGARIA, CULTIVATED STRAWBERRY. Loss from strawberry leaf spot (Mycosphaerella fragariae) did not exceed a trace.

FRAXINUS PENNSYLVANICA var. LANCEOLATA, GREEN ASH. A severe infection of Puccinia peridermiospora occurred in southeastern North Dakota.

MALUS SYLVESTRIS, APPLE. Fireblight (Erwinia amylovora) and scab (Venturia inaequalis) occurred in heavier than average epidemics.

POPULUS spp. Very heavy infections of rust (Melampsora medusae) were found on cottonwood, P. deltoides, throughout the Red River Valley. Cytospora chrysosperma causing canker of poplar, P. tremuloides, was found in scattered localities.

PRUNUS spp. Plum pockets (Taphrina communis) was noted on plum, (P. americana) and on cherries.

RHAMNUS spp., BUCKTHORN. Very severe infection of crown rust (Puccinia coronata) occurred on buckthorns in 1943.

RUBUS STRIGOSUS, RASPBERRY. Very little loss resulted from mosaic (virus).

DISEASES IN SOUTH DAKOTA IN 1943[1]

Ian W. Tervet

Unusually severe infections of certain diseases on field crops were seen in 1943. The bacterial leaf blights on cereals and grasses were very evident, and loss from these diseases was greater than usual. The lack of critical experimental work on the losses resulting from leaf-infecting pathogens such as Pseudomonas (Phytomonas) coronofaciens makes any attempt to estimate reduction in yield a matter of opinion. The pasmo disease of flax unquestionably caused a material reduction in yield of flax in eastern South Dakota but again lack of experimental evidence makes any accurate estimate of losses extremely hazardous.

A very heavy infection of Septoria lycopersici reduced tomato yields considerably; adequate control measures have not been developed and continuation of favorable conditions for epidemics of this disease will result again in severe losses to tomatoes.

Corn was freer from ear rots than in other recent years, loss being relatively slight.

DISEASES OF VEGETABLE CROPS

BETA VULGARIS, BEETS. Aphanomyces cochlioides, Pythium aphanidermatum, P. ultimum, and Rhizoctonia solani, associated with damping-off and root rots, caused some reduction in stand of sugar and table beets.

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[1] The writer acknowledges his gratitude to Dr. W. F. Buchholtz of South Dakota State College for his kind assistance during the course of this survey.

LYCOPERSICON ESCULENTUM, TOMATO. Loss from leaf blight (Septoria lycopersici) was very heavy, the severe defoliation resulting in much low quality sunscalded fruit. Bacterial spot (Xanthomonas vesicatoria) while common on fruits in eastern South Dakota, was not especially severe. Sunscald of the fruits followed defoliation from leaf blight.

PHASEOLUS VULGARIS, BEAN. Bacterial blight (Xanthomonas phaseoli) was noted.

SOLANUM TUBEROSUM, POTATO. Common scab (Actinomyces scabies) was general in the potato section of eastern South Dakota and was severe in many fields in that area. Somewhat less scab was found in Clark County than in eastern Codington and Deuel Counties.

Early blight (Alternaria solani) was common in the principal potato section surrounding Watertown.

(Corticium solani) see Pellicularia filamentosa.

While bacterial ringrot (Corynebacterium sepedonicum) was not observed by pathologists of the South Dakota State College or by the writer, it is probable that some lots of seed are infected. However, no loss from this disease has been observed this year.

Blackleg (Erwinia phytophthora) (E. carotovora) was not uncommon in most fields in eastern South Dakota but losses were slight.

Wilt (Fusarium oxysporum) caused slight loss.

Rhizoctonia canker and black scurf (Pellicularia filamentosa) (Corticium solani) caused slight loss.

Late blight (Phytophthora infestans). A light to moderate vine infection of late blight occurred in eastern South Dakota, but tuber infection was rather more severe than had been expected. Most tuber infection was found in Deuel, Brookings, and Hamline Counties, and the eastern half of Codington County. Only occasional infected tubers were found in the drier potato sections in western Codington and Clark Counties.

All fields showed extensive hopperburn with some loss from this disease.

Most fields of table stock potatoes were rather heavily infected with mosaic (virus) and losses from this disease were high. Spindle tuber (virus) also was common in much of the table stock potatoes.

DISEASES OF CEREALS, GRASSES, AND FORAGE CROPS

AGROPYRON SMITHII, WESTERN WHEAT GRASS. Claviceps purpurea, Puccinia graminis, and P. rubigo-vera, each caused slight damage.

AVENA SATIVA, OATS. Halo blight (Pseudomonas coronafaciens) was present in most oat fields, somewhat more commonly than usual, and caused some reduction in yield, but loss was much less than that caused by crown rust. Crown rust (Puccinia coronata) was the major disease on oats and caused severe injury to much of the crop. Stem rust (P. graminis var. avenae) did some damage in the east-central part of the State, but for the State as a whole loss was slight. Smuts (Ustilago avenae and U. kolleri (U. levis) were found in most fields and losses remained at about the same level as in recent years.

BROMUS INERMIS, BROME GRASS. Bacterial blight (Pseudomonas coronafaciens var. atropurpurea) was heavy on most brome grass in eastern South Dakota. Infection by Selenophoma bromigena was very light and damage negligible.

HORDEUM VULGARE, BARLEY. A very severe epidemic of scab (Gibberella zeae) (G. saubinetii) occurred in the eastern counties; in the central and western sections of the State little scab developed.

Very little leaf stripe (Helminthosporium gramineum) occurred.

Severe damage to barley resulted throughout eastern South Dakota from the spot blotch fungus (Helminthosporium sativum). In addition to severe head blight, yield was reduced because of seedling blight, root rot, stem and leaf infections.

There was some stem rust (Puccinia graminis) but damage was slight; and leaf rust (Puccinia anomala) was generally present but also did little damage.

Loose smuts (Ustilago medians and U. nuda) were found to a limited extent in most fields, Dryland and Spartan being the most susceptible varieties.

Bacterial blight (Xanthomonas translucens) caused some reduction from shrivelling of the leaves. The disease was found in all barley-producing areas.

LINUM USITATISSIMUM, FLAX. Rust (Melampsora lini) was less severe in 1943 than in the previous year. Late-planted flax in the northeastern section suffered most. Very heavy losses from pasmo (Mycosphaerella (Sphaerella) linorum) resulted throughout eastern South Dakota, the greatest intensity of the disease occurring in Deuel County. Loss from pasmo markedly exceeded that from rust, and it was fortunate that yellow flaxes were not grown in South Dakota in 1943.

MEDICAGO SATIVA, ALFALFA. Leaf spot (Pseudopeziza medicaginis) caused slight injury on second-growth alfalfa in the eastern part of the State.

SECALE CEREALE, RYE. Very little ergot (Claviceps purpurea) was seen, and no stem rust (Puccinia graminis). Heavy leaf rust (P. rubigo-vera var. secalis) infection was responsible for greatest reduction in yield of rye. Heavy leaf infection by bacterial blight (Xanthomonas translucens f. sp. secalis) reduced the yield somewhat.

SOJA MAX, SOYBEAN. Most fields were lightly to moderately attacked by bacterial pustule (Xanthomonas phaseoli var. sojense).

SORGHUM VULGARE, SORGHUM. Bacterial stripe (Pseudomonas andropogoni) occurred in the southeastern counties, where practically every field had light to moderate infection with injury especially to the lower leaves. Covered smut (Sphacelotheca sorghi) could be found in most fields, the reduction in the crop being approximately 10%.

SORGHUM VULGARE var. SUDANENSE, SUDAN GRASS. Bacterial spot (Pseudomonas holci) was general in southeastern South Dakota, many leaves being killed by it.

TRIFOLIUM PRATENSE, RED CLOVER. Weather conditions did not favor development of northern anthracnose (Kabatiella caulivora), although the fungus was found in all fields of red clover examined in the southeastern part of the State.

TRITICUM AESTIVUM, WHEAT. Scab (Gibberella zeae) was prevalent in the eastern counties. Some loss also resulted from seedling blight and foot rot due to this fungus.

Seedling blight, foot rot, and head blight caused by Helminthosporium sativum were more generally distributed than similar infection by Gibberella.

Heavy infections of stem rust (Puccinia graminis var. tritici) were seen in central South Dakota on a few fields of Marquis wheat and in the northeastern part of the State on a few fields of black durum, but loss for the State as a whole did not exceed a trace.

The epidemic of leaf rust (Puccinia rubigo-vera var. tritici) (P. triticina) was lighter than normal.

Slight loss probably resulted from leaf infections by Septoria tritici.

Very little bunt (Tilletia foetida) (T. levis) was found.

Black chaff and leaf blight (Xanthomonas translucens f. sp. undulosa) were generally distributed and caused some loss.

ZEA MAYS, CORN. Diplodia zeae, Fusarium spp., Gibberella zeae, and Nigrospora sphaerica were associated with ear rots. Unusually little ear rot was seen. Fusarium foot rot caused some injury especially on sweet corn. Fusarium stalk rot was most common and destructive. Diplodia was less important. Rust (Puccinia sorghi) was present in most fields but the infection was light and loss negligible. Smut (Ustilago maydis) (U. zeae) was widespread but did little damage.

DISEASES OF MISCELLANEOUS HOSTS

FRAXINUS PENNSYLVANICA var. LANCEOLATA, GREEN ASH. Gloeosporium sp. causing leaf spot was common throughout the eastern part of the State. Very heavy infection by rust (Puccinia peridermiospora) was seen in most plantings in northeastern South Dakota.

MALUS SLYVESTRIS, APPLE. Erwinia amylovora, Gymnosporangium juniperi-virginianae, and Venturia inaequalis were present in eastern South Dakota wherever apples were grown, but were not so common as in 1942.

POPULUS DELTOIDES, COTTONWOOD. Infection by rust (Melampsora medusae) in 1943 was much later and somewhat less than in 1942.

PRUNUS BESSEYI, SAND CHERRY. Taphrina sp. was noted on this plant.

NOTES ON DISEASES OBSERVED IN THE NEBRASKA PLANT DISEASE SURVEY, AUGUST TO NOVEMBER, 1943

Stuart M. Pady

SOJA MAX, SOYBEAN. Bacterial pustule (Xanthomonas phaseoli var. sojense) was found in 26 out of 27 fields. While most leaves had a few pustules very few were sufficiently heavily infected to cause very much defoliation. Because weather conditions were not conducive to the spread of this disease, it is not considered that it caused very much damage.

Pod and stem spot (cause unknown). These spots are found on the stems and pods; fruits are deformed and produce no seeds. The spots are black, 3 to 4 mm long, roughly elliptical, shiny, somewhat sunken. They are found rather commonly in Nebraska and Kansas, appearing as the stems begin to mature. No fruiting bodies of a fungus have been found in the spots, although in one case immature bodies were seen. This disease could cause much damage. Fortunately most of the spots occurred on the stems. (See also Kansas report).

Mosaic (virus) was found on a few plants in a few fields. One late-planted field showed 10 to 15% infection. Mosaic does not appear to be a serious disease in Nebraska.

In one field dead stalks were found with the typical fruiting bodies of the anthracnose fungus (Glomerella glycines). Since the field had long since been harvested, the fungus apparently had been growing saprophytically.

Although none was found during the growing season, charcoal rot (Sclerotium bataticola) was present in 2 fields causing the complete rotting of the stubble. In these cases it was clearly a saprophyte.

SOLANUM TUBEROSUM, POTATO. A tuber rot of unknown cause was found in irrigated fields in the Loup and Platte River Valleys in 5 counties. Although loss in one field was 15% the average loss was estimated to be between 3 and 4%. (See PDR 27(17): 375, Sept. 15, 1943).

SORGHUM VULGARE, SORGHUM. Charcoal rot (Sclerotium bataticola) was not abundant on the milo group of sorghums, being found in small amounts in 5 of 25 fields. One field only showed considerable rot, principally confined to one area where there was 34%. It was estimated that loss from this disease in sorghums would not be more than 2%.

Most farmers apparently treat their seed since kernel smut (Sphacelotheca sorghi) was found in only 7 fields, in 4 of them with percentages less than 2. One field only had a relatively high amount, 48%. The estimated loss from smut is 3%.

Weak-neck (genetic) appears to be more abundant where plants have been sown too thickly and where moisture is lacking. It was found in 11 out of 25 fields. Breaking-over of the peduncle was just beginning in most fields.

Bacterial streak (Xanthomonas holcicola) was observed in 2 fields in western Nebraska. It was not serious nor abundant.

ZEA MAYS, CORN. Charcoal rot (Sclerotium bataticola) was the most serious corn disease. It was found in 40 counties, infection being greater in central and western counties where it averaged 29%, and less in eastern counties where the average was 2%. The amount of disease seems to be correlated with low moisture conditions and high temperatures. The disease causes considerable lodging and may also result in decreased yields. The estimated loss over the State was 16%.

Diplodia stalk rot (Diplodia zeae) was found in 27 of the eastern counties. This disease increases in amount eastward, the highest percentages being found in the 2 eastern tiers of counties. The higher moisture and freedom from burning winds probably account for the higher percentages in these counties. The loss was estimated at 19%.

Smut (Ustilago maydis) (U. zeae) was widely distributed in 46 counties. Counts made in 56 fields in 40 counties showed an average loss of 8%.

Ear rots. Nigrospora oryzae cob rot is not especially serious except in some areas in the eastern counties. Secondary ears were highly susceptible. Loss from this disease based on counts in 9 eastern counties is 4%. Diplodia zeae, according to growers, caused less moldy ears than last year. The loss is estimated at 2%, which is low when the high percentage of Diplodia stalk rot in these same counties is considered. It is probable that many ears were infected without showing external symptoms.

The percentage of infection would probably be greatly increased if germination tests were made. Ear rot caused by Fusarium moniliforme was not abundant, the amount being 1%. This organism, along with others, was found following ear-worm injury in 7% of the ears examined.

Rust (Puccinia sorghi), although found in 15 counties, did not occur on many plants nor in large amounts.

Stalk rot (? Fusarium moniliforme). This organism was isolated from corn stalks that had died prematurely from stalk rot in one field in Antelope County.

Bacterial leaf spot and top rot, caused by a bacterium not yet identified. This may be a new disease. The leaf spot was first found in Kansas and material was sent to the Division of Cereal Crops and Diseases for study. The spots are characteristic: pale brown, linear, with narrow reddish-brown margins. It is believed that this organism also causes a top rot of the young plants; several such affected plants were found in Kansas, but none in Nebraska. The leaf spot was found in 5 fields in 5 eastern counties in Nebraska, in small amounts. (See also Kansas report).

Root rot, cause unknown. The roots rotted away, often leaving a hollow cortex. Sometimes small elongated black bodies suggestive of incipient fruiting bodies are found on the roots. Reddish discolorations are often associated. Some of the root rot in the 14 counties is probably charcoal rot prior to formation of sclerotia. In specimens of similarly affected plants sent to him from Kansas Dr. W. W. Ray found 100% Fusarium moniliforme in isolations from vascular bundles of the stems.

NOTES ON THE PLANT DISEASE SURVEY IN KANSAS, AUGUST TO NOVEMBER, 1943

Stuart M. Pady

SOJA MAX, SOYBEAN. Bacterial pustule (Xanthomonas phaseoli var. sojense) is the commonest soybean disease in the State, being found wherever soybeans are grown. Although heavy infections caused some defoliation, weather conditions were apparently unfavorable for the spread of the disease and it did not appear to be causing very much damage in 1943. There is good evidence that the disease is seed-borne, since the greatly increased acreage in 1943 meant that many fields were being grown far from fields where soybeans were grown last year.

Pod and stem spot, cause unknown, was widely distributed, appearing mostly on the stems as the plants begin to mature. When present on the pods seed does not form. No fungous fruiting bodies have been found associated although one collection on old dead stems had immature fruiting bodies present. This disease is definitely not pod and stem blight. Since the disease could easily be very serious, it is one that will bear watching. (See also Nebraska report).

Pod and stem blight (Diaporthe sojae) appears very late and was found this year only on dead stalks following harvest. It is certainly not a serious disease in this State and may be saprophytic.

Anthracnose (Glomerella glycines) was found in a few localities in small amounts on old dead stems, late in the season. It appears to be a saprophyte.

Charcoal rot (Sclerotium bataticola) has been found only on the dead root stocks after growth had been completed. It was widely distributed in 16 counties. The amount depends upon the variety, early-maturing sorts having the highest percentages. In these plants the root system is completely destroyed. Although living plants are reported to have been killed by the fungus in Illinois, none were found affected in Kansas during the growing season.

Mosaic (virus) was found on a few plants in small amounts.

SORGHUM VULGARE, SORGHUM. Milo disease, cause not definitely known. A survey for this disease was made in the western half of the State. In some cases, as when the plants are killed prematurely, it is evident that milo disease is present, but in older plants the symptoms may be confused with drought effects and charcoal rot and the only reliable means of identification is to take a soil sample and make a greenhouse test. Fifty-two such samples were taken from 37 counties. The results of this test are given in PDR 28(10):356-358, Apr. 22, 1944. Loss would not average high since most growers in southwestern and south-central counties use resistant varieties, especially Westland.

Charcoal rot (Sclerotium bataticola) was rather serious, being found in 20 counties, with amounts ranging from a trace to 100% in localized areas. Lodging was becoming increasingly evident. All varieties appeared to be about equally susceptible. Early symptoms (prior to formation of sclerotia) are identical with those of milo disease.

Kernel smut (Sphacelotheca sorghi), in general, was not serious and was found in only 15% of the fields visited, averaging 6%.

Weak-neck (genetic) was present in 27 counties, mostly in the early stages, with off-color heads and brown rachis. In the later stages the discoloration extends to the base of the peduncle and the head breaks over. The variety Colby was found to be very susceptible to breaking-over, while Wheatland and Westland tended to resist it. Thick planting and drought are predisposing factors.

Bacterial streak (Xanthomonas holcicola) although found in 11 counties, was not present in any great amount and did not appear to cause any damage. Bacterial stripe (Pseudomonas andropogoni) was not common or serious.

ZEA MAYS, CORN. Charcoal rot (Sclerotium bataticola), which appears to be the most serious corn disease of 1943, is found abundantly wherever corn is grown except in the northeastern counties. In the northeastern counties the amount was about 6%, in the southeastern and south-central counties 11%, and in the north-central counties 40%. The average for the State is 20%, based on counts made in 70 fields in 38 counties. (Table 1). This disease causes a very high degree of lodging, and if the plant is attacked early there may also be considerable reduction in yield. The distribution of charcoal rot appears to be correlated with low rainfall and high temperatures, which accounts for the high percentages in the central counties and low percentages in northeastern counties (Table 1). There is less rot also in the bottom lands; in the north-central counties upland fields averaged 49%, bottom lands 38%.

Table 1. Relationship between precipitation and *Diplodia* stalk rot and charcoal rot of corn in Kansas, 1943

Area	County	Precipitation June – October	Diplodia stalk rot	Charcoal rot
		inches	%	%
1	Leavenworth	29.27	54	2
Northeast	Jefferson	22.43	26	0
	Atchison	21.02	17	0
	Doniphan	20.83	39	0
	Brown	18.94	59	trace
	Marshall	18.87	26	46
	Nemaha	18.76	44	2
	Pottawatomie	17.99	19	12
	Jackson	17.07	26	8
Average for area		20.57	34	6
	Osage	25.47	28	6
2	Neosho	25.12	5	29
South-	Anderson	24.64	35	9
central;	Shawnee	24.28	15	2
Southeast	Linn	22.88	28	2
	Franklin	22.48	35	4
	Douglas	22.34	39	1
	Lyon	20.51	18	6
	Miami	20.30	85	6
	Johnson	19.73	15	0
	Allen	18.83	8	4
	Chase	17.90	38	18
	Butler	15.34	40	10
Average for area		21.49	30	11
	Riley	25.10	2	34
3	Clay	20.46	6	58
North-	Marion	18.21	1 ?	60
central	Republic	16.72	25	26
	Washington	16.30	0	20
	Rooks	14.59	1	62
	Cloud	13.86	14	19
	Jewell	12.78	4	32
	Mitchell	12.46	5	50
	Phillips	12.27	2	58
	Osborne	11.61	0	32
	Smith	9.58	1	55
Average for area		15.32	6	40
Eastern third of State		20.93	32	8
Middle third of State		14.29	6	40

Diplodia stalk rot (Diplodia zeae) ranks second in importance in the State. It is widely distributed, increasing in amount to the eastward. In the north-central counties it averages 6%; in north-eastern counties 34%. The loss for the State, based on counts made in 38 counties in 70 fields, is 22%. There is much less lodging with this stalk rot than with charcoal rot, and although the amount of infection is higher, it is believed that the loss is not so great. The ears on infected plants did not, for the most part, appear to be poorer than those on healthy plants. The highest percentages of this disease were found in counties receiving greatest rainfall, thus providing favorable conditions for infection. Table 1 shows the relationship between the amount of precipitation and the prevalence of Diplodia stalk rot and of charcoal rot. It will be seen that conditions favoring Diplodia are just the opposite of those favoring charcoal rot.

Other stalk rots are sometimes found, with pink or red discolorations in the tissues. Isolations by Dr. W. W. Ray yielded Fusarium moniliforme and Gibberella zeae (G. saubinetii).

Smut (Ustilago maydis) (U. zeae) was found wherever corn is grown. Counts made in 17 fields in 14 counties gave an average of 3% infection.

Bacterial leaf spot and top rot, causal organism not identified. This disease was observed first in Douglas County. In efforts made to determine the extent of its distribution, leaf spot was located in 7 additional counties; top rot was found in a few cases. In most fields the spotting is not severe. The heaviest infection was found in seed-producing blocks especially in Jewett Hybrids being grown at Sabetha. The disease was not serious in 1943 (See also the Nebraska report).

Rust (Puccinia sorghi) was found in small amounts in 4 counties. Damage was not severe.

Ear rots were not abundant in 1943, as shown by counts made in 25 counties. Cob rot (Nigrospora oryzae) was found in practically every county in small amounts; the average was 2%. It was fairly common on secondary ears. Diplodia ear rot (Diplodia zeae) was not abundant either in cribs or in the field. In general this ear rot was more prevalent in the north-eastern counties where moisture conditions favor infection. Considering the high percentage of Diplodia stalk rot in these counties, it is surprising that the amount of Diplodia ear rot was so low, averaging 2% for the State. Many ears are probably infected but show no external symptoms and the disease would show up only on the germinator. Fusarium ear rot (F. moniliforme) was not abundant, being found in amounts averaging 0.5% for the State. Following ear worm injury, however, this fungus is prevalent, although other fungi may also be present. Ten percent of all the ears examined had Fusarium and other fungi following insect injury at the tips.

Root rot, cause not known. Affected plants are usually prematurely killed and the stalk tissues often show disintegration. The plants are easily pulled out of the ground. The stalks often have pink or black mycelium within. The rotted roots sometimes have black elongated bodies on the surface, suggestive of immature fruiting bodies. Often the roots are red in color. Some of these symptoms are probably caused by charcoal rot, but sclerotia are not present. In one field observed in Jewell County 82% of the plants were lodged; 20% of the lodging was due to charcoal rot and 4% to Diplodia, while many plants were affected by a root rot with no evidence of either of these diseases. From specimens sent to him from this field, Dr. W. W. Ray isolated 100% Fusarium moniliforme (See also Nebraska report).

SUMMARY REPORT OF PLANT DISEASES IN OKLAHOMA, 1943

Howard W. Larsh with assistance of Oklahoma state
plant pathologists and crop specialists

INTRODUCTION

The 1943 season in Oklahoma was strikingly abnormal in several respects, as seen in the following meteorological data:

Month	Mean temperature °F	Departure from long-time average	Mean precipitation inches	Departure from long-time average
Jan.	38.6	+ 0.4	0.08	- 1.34
Feb.	47.0	+ 6.9	0 63	- 0.77
Mar.	46.0	- 4.6	2.01	- 0.11
Apr.	64.3	+ 3.9	2.33	- 1.13
May	66.8	- 1.5	10.27	+ 5.52
June	79.5	+ 2.3	2.76	- 1.15
July	84.0	+ 3.2	0.96	- 1.81

The unprecedented rainfall of May, which resulted in widespread floods, was preceded by a severe late winter and spring drought, and was followed by drought throughout the summer which was accentuated by abnormally high summer temperatures.

These highly irregular but clear-cut deviations from normal Oklahoma weather were responsible for the most outstanding features of the pathological picture for Oklahoma in 1943: (1) disastrous flood damage to corn, and the necessity of replanting corn, cotton, peanuts, and other summer crops at unfavorably late dates; (2) midsummer drought as the principal loss factor in sweetpotatoes, peanuts, cowpeas, corn, and cotton; and (3) unusual destructiveness of fungous diseases that depend largely on May rainfall for their development, and almost total absence of certain other diseases that are dependent for their development on moisture before or after May. Thus, for example, apple scab, normally of little consequence in Oklahoma, was epiphytotic and more destructive than in many years, while elm leaf spot, which causes serious defoliation nearly every year in this State, was hardly noticeable. March was a colder month than February in 1943, which was a decisive factor in inhibiting the development of wheat leaf rust and crown rust of oats to such an extent that no serious loss resulted, although the May rains enabled these rusts to become quite noticeable at harvest time in June.

In future attempts to correlate the incidence of plant diseases with meteorological conditions, analysis of the season of 1943 in Oklahoma may be expected to yield unusually clear-cut evidence of the dependence of certain diseases on rainfall before, during, or after May respectively.—(K. Starr Chester).

DISEASES OF VEGETABLE CROPS

ALLIUM CEPA, ONION. Scattered reports indicate that bulb rots (Botrytis allii, Erwinia carotovora, and Fusarium spp., principally) were as destructive as usual, accounting for losses of 25% to 75% of onions placed in uncooled storage for the summer. (Chester)

ASPARAGUS OFFICINALIS, ASPARAGUS. Cercospora stem spot (C. caulicola) was not observed to be responsible for killing back stems and branches of asparagus in the fall as in 1942, although searched for in the same planting. The disease appears late in the season, after the main period of food storage, and is probably relatively non-injurious. (Chester).

BETA VULGARIS, BEET. Leaf spot (Cercospora beticola), the only beet disease of even moderate importance in Oklahoma, was much less noticeable than usual. (Chester)

CAPSICUM FRUTESCENS, PEPPER. Fruit spot (Alternaria sp.) was very apparent in all plantings, causing an estimated loss of nearly 5% in the most severely infested plantings. Wilt (Verticillium albo-atrum) was observed causing a loss of nearly 15% in 2 plantings. Other plantings were affected less severely.

CITRULLUS VULGARIS, WATERMELON. Anthracnose (Colletotrichum lagenarium) was well distributed in the watermelon-growing regions of the State. One planting had an infestation of nearly 30%. Blossom-end rot (Diplodia sp.) was extremely prevalent this year. Many fruits were lost due to early Diplodia infections. Secondary organisms were apparent in the lesions made by Diplodia. Wilt (Fusarium oxysporum f. niveum) (F. bulbigenum var. niveum) caused up to 15% loss in plantings of susceptible varieties on infested soil. Fusarium wilt was well-distributed in the principal watermelon-growing regions of the State. Many fields have been abandoned because the soil is so heavily infested with the wilt organism.

CUCUMIS MELO, CANTALOUP. Leaf blight (Alternaria cucumerina) (Macrosporium cucumerinum) was present in most of the plantings in the State. Because of the dry hot weather little loss was sustained. Bacterial wilt (Erwinia tracheiphila) was very serious in 2 large plantings. Nearly 100% loss was observed in one case in southeastern Oklahoma; other plantings revealed losses of plants up to about 5%.

CUCUMIS SATIVUS, CUCUMBER. Leaf blight (Alternaria cucumerina) caused necrotic leaf spots in several plantings. Nevertheless, the most severe infections did not reduce the leaf surface more than 1%. Adverse weather conditions prevented the development and dissemination of the causal organism.

Specimens revealing typical symptoms of downy mildew (Pseudoperonospora cubensis) were difficult to locate. Early infections were observed on 3 or 4 plants but the infection failed to develop to the point where loss was more than negligible. The inoculum was present early in the season but climatological conditions prevented the development and spread of the disease.

Bacterial wilt (Erwinia tracheiphila) was less prevalent on cucumbers than on cantaloups. A loss of nearly 1% was apparent in one late planting of cucumbers.

IPOMOEA BATATAS, SWEETPOTATO. Two plants were observed killed by Java black rot (Diplodia tubericola); however, these plants had grown from an infected root stock.

Black rot (Endoconidiophora (Ceratostomella) fimbriata) was observed in 2 plantings during 1943. The loss was limited to 4 plants in one planting and 2 in the other. The certified plant program has aided considerably in reducing the amount of black rot on sweetpotatoes in Oklahoma.

Stem rot or wilt (Fusarium oxysporum f. batatas) (F. bulbigenum var. batatatis) was the most widespread and prevalent disease of sweetpotato during 1943 in Oklahoma. Several plantings were observed in which a loss of 2 or 3% was not at all uncommon. Losses in some of the more severely attacked plantings were greater than 10%.

Considerable loss in sweetpotato culture resulted from the extreme drought this season. Sweetpotato leaves suffered a large reduction in the content of chlorophyll. All plantings with the exception of those which were irrigated showed yellowed leaves.

LYCOPERSICON ESCULENTUM, TOMATO. One of the 3 most prevalent diseases of tomatoes in Oklahoma in 1943 was Fusarium wilt (F. oxysporum f. lycopersici) (F. bulbigenum var. lycopersici). Several plantings were observed in which the loss was over 5%. Varieties that have been more or less resistant revealed wilted plants this season.

Early infections by leaf spot (Septoria lycopersici) caused severe defoliation in some regions of the State. However, late infections were prevented by adverse weather conditions. In irrigated plantings infections were severe and caused considerable defoliation.

Bacterial canker (Corynebacterium michiganense) was observed in 2 plantings; however, only 4 or 5 plants were infected.

Infection by the rootknot nematode (Heterodera marioni) was observed in all sections of the State. Considerable damage was inflicted to commercial plantings, as well as comparable losses in home gardens. This is probably the most serious disease of tomato, considering the State as a whole.

Mosaic(virus) was widespread in Oklahoma but caused very little damage. In most of the plantings the infection was limited to only a few plants.

Blossom-end rot (physiogenic) probably caused the greatest loss in tomatoes this season. It was not at all uncommon to see from 1/8 to 1/4 of the fruits affected.

Red spiders were very destructive to tomato foliage in June and July.

PHASEOLUS AUREUS, MUNG BEAN. Leaf and pod blight (Xanthomonas phaseoli) was prevalent on leaves and pods. Defoliation could be detected in most of the plantings observed. In some instances pods were attacked severely. A loss of from 5 to 10% of the leaf area was observed in some plantings.

Yeast spot (Nematospora coryli). Mung beans collected from plantings at Enid and Stillwater revealed yeast spot infections. As in soybeans this particular disease may be more widespread than present reports indicate.

Dry root rot (charcoal rot) (Macrophomina phaseoli=Sclerotium bataticola). Early plantings of mung beans revealed considerable loss due to the sclerotial stage. Losses of 2 to 3% were not at all uncommon in early plantings.

PHASEOLUS LUNATUS, LIMA BEAN. Colletotrichum blight (C. truncatum) was observed on and in mature pods and on the seeds. The conidia developed after picking while the pods were drying. Blight was associated

with a cottony leak disease caused by a species of Pythium. Powdery mildew (Erysiphe polygoni), which was very common in 1942, was practically absent this year. Some Cercospora leaf spot (Cercospora cruenta) was observed. The dry root rot caused by Macrophomina phaseoli was present late in the season. None of these diseases was responsible for much loss.

PHASEOLUS VULGARIS, BEAN. In the early and middle parts of the season the effects of diseases were obscured by widespread destruction by bean leaf beetles followed by red spider injury in June. Bacterial blight (Xanthomonas phaseoli) did not appear to be as prevalent as usual. Toward the end of the season many plantings were brought to an untimely end by dry root rot caused by Macrophomina phaseoli. (Chester).

PISUM SATIVUM, ENGLISH OR GARDEN PEA. Poor stands with non-treated seed were experienced by gardeners this year. The cause was probably due to Pythium spp. and Rhizoctonia solani. Late-maturing varieties were affected rather severely by powdery mildew (Erysiphe polygoni) but the disease was less prevalent than in 1942. Heavy rains in May caused peas to crack open within the pods. (W.W.Ray).

RHEUM RHAPONTICUM, RHUBARB. Crown rot (Phytophthora cactorum) was reported as very destructive in Oklahoma County. (Chester).

SOLANUM TUBEROSUM, POTATO. As usual there were no reports of late blight (Phytophthora infestans) in either spring or fall crops. Cracking and enlarged lenticels, due to the May rains following drought, were common grading factors. Dry root rot (Macrophomina phaseoli) was very destructive to tubers with losses reaching 75% in Payne County. Rhizoctonia (R. solani = Pellicularia filamentosa (Corticium vagum))was unusually prevalent. (Chester).

SPINACIA OLERACEA, SPINACH. The upper leaves were infected with leaf spot (Alternaria sp.). Infection was moderate but the economic loss was not more than 1%. Downy mildew (Peronospora effusa) was very limited in extent in the 1943 season. The lower leaves of a single planting were affected, with slight defoliation and negligible loss.

DISEASES OF CEREALS, GRASSES, AND FORAGE CROPS

GRASSES. Ergot (Claviceps purpurea), which was epiphytotic in 1942 on large blue stem (Andropogon furcatus), sand blue stem (Andropogon hallii), Indian grass (Sorghastrum nutans), wild rye (Elymus canadensis and E. virginicus), and western wheat grass (Agropyron smithii), was virtually absent from these or other grasses in 1943, nor were the grass rusts observed in any important amount. (Chester).

MEDICAGO SATIVA, ALFALFA. Leaf spot (Pseudopeziza medicaginis) was difficult to locate. Losses varied from a trace to not more than 1%, as is usual in Oklahoma. Alfalfa rust (Uromyces striatus var. medicaginis) was apparent in older plantings in the alfalfa-growing regions of the State. Infection was observed in 4 localities where the loss was estimated as from a trace to 2% in older plantings.

SOJA MAX, SOYBEAN. Soybean plants revealing typical frog-eye leaf spot (Cercospora sojina) were very difficult to find. Observations and collections of diseased specimens were limited to 2 or 3 plantings. The amount of loss in each instance was negligible.

Pod and stem blight (Diaporthe phaseoli var. sojae) was apparent in 3 plantings in Oklahoma during the past season. A loss of nearly 2% could be attributed to this disease in 2 of the plantings. Plants in many

other areas revealed symptoms characteristic of this disease; however, fruiting bodies were not apparent.

Anthracnose (Glomerella glycines) was observed causing considerable damage to nursery plantings in the State; however, this particular disease was not apparent in commercial plantings.

Loss due to wilt (Fusarium oxysporum f. tracheiphilum)(F. bulbigenum var. tracheiphilum) was negligible, although it was not too difficult to locate wilted plants in 2 diseased plantings.

Nematospora coryli, the causal organism of yeast spot in lima beans, caused a great deal of damage to soybeans in Oklahoma. Isolations of the fungus from soybeans collected at Stillwater have been made without any difficulty. An estimation of the loss due to yeast spot cannot be made at present; however, judging from prevalence in this region it could well become one of the major diseases of soybeans.

Dry rootrot (charcoal rot) (Macrophomina phaseoli=Sclerotium bataticola). Lodging due to the sclerotial stage was apparent in early plantings. In no instance, however, was the loss greater than 1%.

Bacterial blight (Pseudomonas glycinea) was widespread in its distribution during this season. In several plantings moderate defoliation resulted from attacks of blight in combination with the pustule disease. In degree of prevalence blight was less than pustule disease in Oklahoma.

Considerable damage was done by bacterial pustule (Xanthomonas phaseoli var. sojense). In 2 plantings severe defoliation resulted. This was the most prevalent and widespread disease during the past season in Oklahoma.

Soybean plants affected with mosaic (virus) were observed in most plantings. In commercial plantings the loss was negligible; however, in nursery plantings several varieties revealed large numbers of affected plants.

SORGHUM VULGARE, SORGHUM. Anthracnose (Colletotrichum graminicolum), in moderate infestations, was found in 6 out of 12 broomcorn plantings located in 2 counties.

Fusarium stem infection (Fusarium spp.) was very widespread. Infestations were moderate to severe; economic importance was negligible to slight. The late cool spring rendered seedlings susceptible to blights.

During the current year leaf spot (Helminthosporium sp.) was very sparse and limited in distribution, causing very little loss in leaf surface due to necrotic lesions.

Milo disease (Pythium arrhenomanes) was observed in plantings in various sections of the State. In plantings of susceptible varieties loss up to 5% could be attributed to it. Most varieties planted were more or less resistant, hence the loss was negligible.

Dry root rot (Charcoal rot) (Macrophomina phaseoli=Sclerotium bataticola). The sclerotial stage was widespread in Oklahoma during 1943. In commercial plantings losses associated with this organism of 2 or 3% were not at all uncommon. In nursery plantings at Perkins and Woodward one variety was nearly 80% affected.

Loose kernel smut (Sphacelotheca cruenta) was limited in its distribution this season, only a few infected heads being observed.

In fields in which the seeds had been treated chemically before planting very few examples of covered kernel smut (Sphacelotheca sorghi) were found. A loss of nearly 5% was observed in several plantings from untreated seed.

Kernel smut (hybrid?). Specimens of a kernel smut differing from loose or covered smut, tentatively identified as a hybrid, were found in 3 plantings in Oklahoma in 1943. The loss in infected plantings was negligible.

Bacterial stripe (Pseudomonas andropogoni) occurred sparsely during the past season, with negligible loss in most plantings.

Bacterial leaf spot (Pseudomonas syringae) was scattered in its distribution, causing very little loss except in one 40-acre planting in southwestern Oklahoma. An estimated loss of over 20% of the photosynthetic surface in this particular field was noted.

Bacterial streak (Xanthomonas holcicola) was the most widespread of all the bacterial diseases of sorghum in Oklahoma during 1943. Specimens could be found in most of the plantings surveyed; neverthelss, more than 10% of the foliage was affected only rarely.

TRITICUM AESTIVUM, WHEAT. Damage from rusts was comparatively slight. Leaf rust (Puccinia rubigo-vera var. tritici) (P. triticina), though prevalent by harvest time in June, developed too late in the season to be of importance. Stem rust (Puccinia graminis var. tritici) occurred in very insignificant amount. No reports were received of unusual amounts of wheat smuts (Tilletia spp., Ustilago tritici). Foot and root-rot (Helminthosporium sativum) was destructive in a number of localities, evidently more so than in normal years, its destructiveness being associated with devitalization of the plants from drought followed by excessive rain in May. (Chester).

VIGNA SINENSIS, COWPEA. In most plantings slight to moderate infestations of leaf spot (Cercospora cruenta) were observed. Defoliation was apparent late in the season, but too late to cause much loss.

Powdery mildew (Erysiphe polygoni) was observed in one irrigated planting this season where it was causing a loss of approximately 1%.

Wilt (Fusarium oxysporum f. tracheiphilum) (F. bulbigenum var. tracheiphilum) was observed in plantings where susceptible varieties had been seeded. Losses in these plantings were estimated at 5%.

Very little loss resulted from rust (Uromyces phaseoli var. vignae) infection of cowpeas in Oklahoma this season. Examples of infected plants were observed in the northwestern part of the State. Not over 1.5% of the foliage was affected.

Dry root rot (charcoal rot) (Macrophomina phaseoli). The pycnidial stage was extremely prevalent this season, and considerable loss resulted from infection by this fungus. It was not at all uncommon to find fields in which the loss was estimated as nearly 20%.

Bacterial canker (Pseudomonas syringae)[1]. Considerable damage resulted from bacterial canker infestations. Severe losses were observed in 2 or 3 plantings. In general, losses fluctuated from a trace up to 20% depending on the variety. From all indications this particular disease is one of the more serious maladies of cowpeas.

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[1] (Burkholder describes the organism causing a similar disease of cowpeas in Texas as Xanthomonas vignicola n. sp. (Phytopath. 34: 430-432. Apr. 1944). See also Hoffmaster (Phytopath. 34: 439-441. Apr. 1944).

ZEA MAYS, FIELD CORN. Ear rots (Diplodia zeae and Fusarium sp., probably moniliforme). Loss from ear rots ranged from a trace to 1 or 2%. Diplodia and Fusarium were found in plantings scattered throughout the State.

Stalk rot (Diplodia frumenti). Collections have been made of this disease in Oklahoma. How serious the infestation is remains to be determined by future work. Two collections have been made in which D. frumenti has been isolated and determined to be the causal organism. Many other similar specimens have been collected but culture work has not been completed.

Smut (Ustilago maydis) (U. zeae) was widespread in plantings this season. Losses ranged from 1 to 15%. A conservative estimate of the infection in a planting at Seiling was 15%.

Dry root rot (charcoal rot) (Macrophomina phaseoli=Sclerotium bataticola). Lodging was present in some degree in all plantings observed. Losses fluctuated from a trace in late plantings to 10% or more in early plantings. Lodging was very apparent in the region from Chickasha to Lawton on early maturing corn.

Insect damage. Injury resulting from insect infestations caused considerable damage throughout the State. Attacks of earworm, lesser cornstalk borer, and southwestern corn borer were apparent in nearly every region in the State.

DISEASES OF FRUIT AND NUT CROPS

AMYGDALUS PERSICA, PEACH. As a result of the late freeze in Oklahoma very few peach fruits were set. Therefore, a comprehensive estimate of loss due to scab (Cladosporium carpophilum) could not be made. In 1 or 2 orchards where a small crop of fruit was set, fruits revealing scab infections were fairly common, suggesting possible loss from the disease if a normal crop had been produced. Leaf infections were very prevalent and widespread.

Only a few fruits were available for observation on brown rot (Monilinia (Sclerotinia) fructicola) incidence this season. Nevertheless, mummies clinging to the trees and on the ground were suggestive that brown rot had been prevalent earlier. Very few examples of brown rot were observed on marketable fruit of late-maturing varieties.

A single record of leaf curl (Taphrina deformans) constitutes the known distribution of this disease in Oklahoma in 1943. The loss in this particular orchard was negligible since only a single tree was infected.

Bacterial spot (Xanthomonas pruni) was found to be the most serious disease of peach in this region. Severe defoliation occurred in most orchards examined. Trees free from bacterial spot were extremely difficult to find. Fruit infections were found in all orchards where fruits were set.

CARYA ILLINOENSIS, PECAN. Brown leaf spot (Cercospora fusca) was found causing slight damage to the varieties Stuart and Moneymaker in one planting. Infection was slight and very little, if any, defoliation occurred.

Downy spot (Mycosphaerella caryigena) was observed causing severe defoliation in one planting. Many varieties were affected by this disease which is becoming more apparent in Oklahoma.

Scab (Cladosporium effusum) was found to be the most widespread and

prevalent disease of pecans in Oklahoma during 1943. In orchards where spraying was not practised severe defoliation due to scab was apparent. Scab was severe on Burkett and Squirrel's Delight varieties in 2 of the plantings surveyed and severe defoliation resulted on both varieties.

Characteristic lesions of the vein spot disease (Gnomonia nerviseda) were apparent on the varieties Burkett and Stuart. The spots, which originate on the very small veins, were circular and about 1/16 inch in diameter. Infection was light and no defoliation resulted.

FRAGARIA, STRAWBERRY. Very little loss due to leaf blight (Dendrophoma obscurans) was apparent during 1943. Leaf spot (Mycosphaerella fragariae) was more prevalent than leaf blight; however, loss was negligible this year.

MALUS SYLVESTRIS, APPLE. Sooty blotch (Gloeodes pomigena) was present in several of the plantings observed but damage was negligible.

Isolated cases of apple-rust (Gymnosporangium juniperi-virginianae) were observed. Leaf infections were light to moderate in affected orchards. A single case was observed in which the fruit was infected.

Fly speck (Leptothyrium pomi) occurred in amounts comparable to, and usually associated with, sooty blotch. In no instance was infection assuming commercial importance; the disease was merely a minor factor in grading.

Fruit rot (Penicillium sp.) was found accompanying insect damage.

Blotch (Phyllosticta solitaria) was severe on early-maturing susceptible varieties. In one orchard of Yellow Transparent nearly 100% infection was estimated. Dry hot weather reduced the amount on late-maturing varieties; however, on several varieties the disease was observed causing a loss of about 5%.

Black rot (Physalospora obtusa) was the most serious disease in eastern Oklahoma apple orchards. Losses of 1 to 10% were apparent in various orchards surveyed. Leaf, fruit, and twig infections were observed in nearly every orchard.

Brown rot (Monilinia (Sclerotinia) fructicola) was in most instances associated with injury to the fruit, either mechanical or from insects. Loss was negligible.

Scab (Venturia inaequalis), as a rule, is of minor importance in Oklahoma. This year, however, infection approached in amount outbreaks more normal to regions having more rainfall than does Oklahoma. Losses as high as 30% were observed in orchards normally having less than 1% damage. In neglected orchards losses were more extreme. In some instances most of the apples were used primarily for cider.

Considerable damage was done by fireblight (Erwinia amylovora) in certain localities. In the State as a whole the attack could be considered as light. Some neglected orchards have suffered severe mortality from fireblight attacks over the past few years.

PRUNUS spp., CHERRY. Leaf spot (Coccomyces hiemalis), in the most severely affected orchard observed in the State, caused defoliation estimated at 20%. Most of the trees observed in other orchards had 5% or less defoliation. A loss of 2% due to brown rot (Monilinia (Sclerotinia) fructicola) was observed in orchards.

PYRUS COMMUNIS, PEAR. Leaf blight (Fabraea maculata) was observed in only one orchard where slight defoliation resulted. Black rot (Physalospora obtusa) of the fruit was observed in 2 plantings, causing a loss of 10 to 15%. Scab (Venturia pyrina) was observed on a single tree.

Twig infection was not observed.

The greatest loss due to fireblight (Erwinia amylovora) observed this year was 15%. Many trees were infected but in most cases the loss was not more than 2%.

RUBUS spp., CANE FRUITS. Blackberry anthracnose (Elsinoë veneta) was observed in an old planting causing a loss of nearly 20%. Other plantings showed less severe attacks; however, a total loss of 5% could be estimated. Orange rust (Gymnoconia peckiana) was observed in a single planting during the past year. Cane blight (Leptosphaeria coniothyrium) was observed in one raspberry planting on only 4 canes.

VITIS spp., GRAPE. Black rot (Guignardia bidwellii) was very prevalent in most of the plantings observed. In one planting a loss of nearly 60% could be attributed to black rot. Downy mildew (Plasmopara viticola) infection of the leaves appeared early in the season; however, owing to adverse weather conditions, very little loss resulted from these early infections.

DISEASES OF SPECIAL CROPS

ARACHIS HYPOGAEA, PEANUT. Leaf spot (Cercospora personata) was observed throughout the peanut-growing regions, but, with the exception of one or two plantings located in the "bottom lands", it caused very little damage. Defoliation was apparent near the end of the growing season in some localities. A loss of 1 or 2% of the leaf surface was not at all uncommon.

Stem and root rots (Rhizoctonia sp. and Fusarium sp.) Early in the season considerable loss due to Rhizoctonia was observed. In some plantings a loss of nearly 5% could be attributed to it. Later in the season Rhizoctonia was observed causing the death of more mature plants; however, the loss was never greater than 2%.

Fusarium-infected plants were observed in 2 or 3 plantings. In 2 collections, late in the season, Fusarium was isolated from necrotic lesions on the roots and stems.

Diplodia stem infection (Diplodia frumenti) Several collections of Diplodia frumenti-infected peanuts were made during the past season. How serious this fungus is on peanuts in Oklahoma is difficult to say on the basis of the few examples collected.

GOSSYPIUM, COTTON. Leaf spots (Alternaria sp. and Cercospora sp.) were very prevalent and widespread during the past growing season. Considerable defoliation occurred rather early in the season suggesting that losses may have been much greater than in past years. Cercospora leaf spot, considering the State as a whole, was more prevalent than Alternaria spot.

Fusarium wilt (F. oxysporum f. vasinfectum) was found less frequently than in past years. This may be explained in one of two ways: (1) resistant varieties are being planted in regions where wilt was severe in the past; (2) weather conditions were so adverse that soil temperatures may have prevented severe infections by Fusarium.

Root rot (Phymatotrichum omnivorum) probably accounted for the actual death of a higher percentage of plants than any other single disease. Losses in several plantings exceeded 15%. In one planting the infection was nearly 40%. Root rot was found in a new location (Davis) in the State this year. The amount of damage in this new area was less than 1%.

Verticillium wilt (V. albo-atrum) was observed in 2 plantings this year. The amount of loss was less than that caused by Fusarium wilt.

Angular leaf spot (Xanthomonas malvacearum) was not so widespread as in past seasons. Early in the season several plantings were observed with primary infections. Late in the season it was rather difficult to locate the disease; however, in regions where the so-called "local rains" fell, a considerable amount of angular leaf spot was found.

Boll rots were negligible. Four or five plantings revealed minor losses due to boll rots in which the angular leaf spot bacterium caused the primary infection.

Soil deficiencies (manganese and potassium). Cotton plants were observed in various regions showing signs of manganese and potassium hunger. Whether the soils were deficient or the minerals non-available owing to dry weather was not determined.

PLANT DISEASES OBSERVED IN TEXAS DURING 1943

G. M. Watkins

The following summary of plant diseases in Texas during 1943 was compiled from observations made by eleven persons, including the writer. Each item was contributed by one of the following observers, indicated by initials: Mr. I. M. Atkins, Dr. A. A. Dunlap, Dr. W. N. Ezekiel, Dr. G. H. Godfrey, Dr. S. S. Ivanoff, Dr. H. W. Larsh, Dr. E. W. Lyle, Dr. E. C. Tullis, Dr. R. D. Watson, Dr. P. A. Young, and the writer.

VEGETABLE CROPS

ALLIUM CEPA, ONION. Alternaria (Macrosporium) porri, purple blotch and leaf blight, was serious in March in Nueces County in the Coastal Bend region (GHG).

Fusarium spp., bulb rot, was generally scattered in Dimmit County in the Winter Garden region. A trace occurred in most fields, but it was severe in one (SSI).

Peronospora destructor, downy mildew, was seen for the first time in Texas in 1943, in Dimmit County where it caused 5% loss (SSI).

Phoma terrestris, pink root, occurred throughout the Winter Garden district, causing losses of 5 to 15% (SSI).

Sclerotium sp., white mold, was general throughout the Winter Garden region (SSI).

Leaf blight or tip blight (nonparasitic) was general throughout the Winter Garden district where loss was 10% (SSI). It was observed in Calhoun and Nueces Counties on the Gulf Coast (AAD).

BETA VULGARIS, BEET. Cercospora beticola, leaf spot, was observed causing losses in yield averaging 2% in several fields each in Hidalgo, Webb, Maverick, and Bexar Counties (GMW). The disease was general throughout the Winter Garden district, the loss amounting to 5% (SSI). Light to moderate infection was observed in Hidalgo County (HWL).

Southern blight (Sclerotium rolfsii) and the virus diseases curly top and mosaic were scattered throughout the Winter Garden district, occurring in trace amounts (SSI).

BRASSICA spp. Peronospora parasitica, downy mildew, and Xanthomonas campestris, black rot, occurred throughout the Winter Garden district. The former was generally distributed and caused loss averaging 2%; scattered infections of the latter resulted in 5% loss (SSI).

BRASSICA OLERACEA var. ACEPHALA, COLLARDS. Infection of 100% with the rootknot nematode, Heterodera marioni, was observed in one home garden in Nacogdoches County in east Texas (GMW).

BRASSICA OLERACEA var. BOTRYTIS. Alternaria circinans (A. brassicae), leaf spot, was observed in Bexar County (AAD). Peronospora parasitica, downy mildew, caused negligible damage in Dimmit County (HWL).

BRASSICA OLERACEA var. CAPITATA, CABBAGE. Leaf spot (Alternaria circinans) (A. brassicae) and black rot (Xanthomonas campestris) caused negligible losses in Bexar and Maverick Counties. Downy mildew (Peronospora parasitica) was observed in several plantings in Hidalgo County, causing slight to moderate damage. Watery soft rot (Sclerotinia sclerotiorum) caused 5% loss in 2 plantings examined in Bexar County (HWL).

A few plants affected by mosaic (virus) were seen in Hidalgo County (GMW).

CAPSICUM FRUTESCENS, PEPPER. Alternaria solani, early blight, occurred in traces throughout the Winter Garden region (SSI).

Cercospora capsici, leaf spot, was widespread but causing little damage in the Winter Garden region (HWL). It was of slight importance in 2 fields observed in Cherokee County in east Texas. A trace was noted on 120 acres in Zavala County in the Winter Garden district (GMW).

Fusarium annuum, wilt, caused considerable damage in Maverick County in the Winter Garden region (HWL).

Gloeosporium piperatum, anthracnose, occurred in traces scattered throughout the Winter Garden district (SSI).

Sclerotium rolfsii, southern blight, was generally distributed throughout the Winter Garden district where it caused 5% loss (SSI).

Verticillium albo-atrum, wilt, was prevalent and widespread in the Winter Garden district, causing losses ranging from a trace to 15% (HWL).

Xanthomonas vesicatoria, bacterial spot, was observed causing negligible loss in 2 plantings in Maverick County (HWL).

Heterodera marioni, rootknot, caused complete loss in 2 acres observed in Fort Bend County (GMW).

Cuscuta arvensis, dodder, was causing slight damage in 1 field in Cherokee County (PAY & GMW).

Curly top (virus) was scattered throughout the Winter Garden district, where it caused 1% loss (SSI). It was observed causing 0.5% loss in one field in Webb County (HWL).

Mosaic (virus) caused loss averaging 1% in numerous fields observed in Hidalgo County and in several fields in Maverick and Webb Counties. It was severe in a 2-acre field in Fort Bend County. A 1/10-acre field in Cherokee County suffered about 50% loss (GMW). Mosaic was general throughout the Winter Garden district where the loss averaged 40% (SSI). In the Winter Garden and Lower Rio Grande Valley districts losses in fields examined ranged from 1 to 100% (HWL).

Sun scald (nonparasitic) damaged from 3 to 5% of the fruits in several fields noted in El Paso County (GMW).

CICHORIUM ENDIVIA, ENDIVE. A trace of aster yellows (virus) was observed in a 1-acre field in Dimmit County (GMW).

CITRULLUS VULGARIS, WATERMELON. Leaf blight (Alternaria cucumerina) was severe in Cherokee County (PAY). Anthracnose (Colletotrichum lagenarium) and downy mildew (Pseudoperonospora cubensis) were generally distributed throughout the Winter Garden district where the loss from each disease was estimated at 5% (SSI). Wilt (Fusarium oxysporum f. niveum) (F. bulbigenum var. niveum) killed 3% of the plants in one 20-acre field examined in Erath County (GMW).

CITRULLUS VULGARIS var. CITROIDES, CITRON. Charcoal rot (Sclerotium bataticola) was noted in Cherokee County (PAY).

CUCUMIS MELO, CANTALOUP. Erysiphe cichoracearum, powdery mildew, was general throughout the Winter Garden district and caused 1% loss (SSI). A trace was observed in Hidalgo County in the fall (GHG).

Pseudoperonospora cubensis, downy mildew, was observed in small amounts on experimental plantings in Hidalgo and Dimmit Counties in the fall (GMW). The disease was general throughout the Winter Garden district and caused loss amounting to 25% (SSI). In Hidalgo County downy mildew was scarce in the spring but occurred abundantly in the fall (GHG). A loss of 10% was caused in Bell County (EWL).

Sclerotium rolfsii, southern blight, occurred abundantly on cantaloup in Hidalgo County in the spring (GHG). A trace was observed in Walker County in east Texas in the spring (GMW).

Heterodera marioni, rootknot, was abundant in Hidalgo County (GHG).

Small amounts of mosaic (virus) were observed in Hidalgo and Dimmit Counties (GMW). Mosaic was general throughout the Winter Garden district where it caused 10% loss (SSI).

CUCUMIS SATIVUS, CUCUMBER. Downy mildew (Pseudoperonospora cubensis) and mosaic (virus) were general throughout the Winter Garden district. Estimated losses were 40% from downy mildew and 15% from mosaic (SSI).

Chlorosis (physiogenic) was observed in Dallas County (AAD).

CUCURBITA MAXIMA, SQUASH. Erysiphe cichoracearum, powdery mildew, killed 100% of the plants in one field observed in Dimmit County (GMW). Powdery mildew was widespread in the Winter Garden district, causing losses averaging up to 2% (HWL).

In one 20-acre field in Hidalgo County in the Lower Rio Grande Valley, Pseudoperonospora cubensis, downy mildew, was causing 50% loss (GMW), and nearly 100% loss in one small planting in this county (HWL), but in most fields it affected only the lower leaves (GHG). The disease was causing from 1 to 15% loss in fields examined in Dimmit County in the Winter Garden district (HWL).

Mosaic (virus) affected 5% of the plants in one 20-acre field observed in Hidalgo County (GMW). Slight loss resulted from mosaic in plantings examined in Hidalgo and Dimmit Counties (HWL).

CUCURBITA MOSCHATA. Mosaic (virus) occurred in scattered infections throughout the Winter Garden district, causing loss ranging from 10 to 25% (SSI).

DAUCUS CAROTA, CARROT. Leaf blight (Alternaria carotae) and southern blight (Sclerotium rolfsii) were generally distributed throughout the Winter Garden district, losses from each disease averaging 2% (SSI).

Aster yellows (virus) caused from 25 to 80% loss, averaging 40%, on mature plants in numerous fields examined in Zavala and Dimmit Counties in the Winter Garden region (GMW). The disease was general throughout the Winter Garden district, loss in affected fields varying from a trace to 15%, averaging 4% (SSI), extent of infection observed ranging from

none to 69% (HWL). In the Lower Rio Grande Valley one field was observed in Hidalgo County with 7% infected plants, and slight loss was noted in a field in Cameron County (HWL).

IPOMOEA BATATAS, SWEETPOTATO. Actinomyces ipomoeae, soil rot, was present on from 3 to 5% of all roots seen in Smith, Upshur, Camp, Titus, and Brazos Counties in east Texas, and occasional lots with 20% or more were encountered in all of these counties (GMW).

Endoconidiophora (Ceratostomella) fimbriata, black rot, occurred in trace amounts in one shed inspected in Smith County and in one in Upshur County (GMW). The disease was observed in Upshur County (AAD).

Fusarium sp., surface rot, was noted in Brazos and Hardin Counties (AAD).

Rhizopus sp., rot, occurred to a greater or less extent in all lots of stored roots examined in Smith, Upshur, Camp, and Titus Counties (GMW).

Sclerotium bataticola, charcoal rot, was observed in Smith County (AAD).

Heterodera marioni, rootknot, was noted on sweetpotato in Brazos County (AAD).

LACTUCA SATIVA, LETTUCE. Sclerotinia sclerotiorum, drop, was observed to be causing 3% loss in 1 planting in Bexar County (HWL).

A trace of aster yellows (virus) was observed in a 1-acre field in Dimmit County (GMW). The disease was general in Maverick County, where loss in fields examined averaged 1% (SSI). From 5 to 30% loss was noted in fields in Bexar and Dimmit Counties (HWL).

LYCOPERSICON ESCULENTUM, TOMATO. Alternaria solani, early blight, was generally distributed but usually not serious (GMW). Infection was general throughout the Winter Garden district and loss averaged 1% (SSI). In Cherokee County 100% defoliation was observed in a 2-acre field (PAY) The disease occurred generally in fields observed in the Winter Garden district and the Lower Rio Grande Valley, but damage was usually slight (HWL).

Alternaria (Macrosporium) tomato, nailhead spot, occurred in traces in fields scattered throughout the Winter Garden district (SSI).

Corynebacterium michiganense, bacterial canker, was observed in Gillespie County (WNE).

Fusarium oxysporum f. lycopersici (F. bulbigenum var. lycopersici), wilt, caused 100% loss in one 3-acre field examined in Atascosa County (GMW). Loss of 3% was general throughout the Winter Garden district (SSI). Up to 5% damage was observed in fields examined in Dimmit, Maverick, and Atascosa Counties, and up to 2% in several plantings in Hidalgo County (HWL).

Phoma destructiva, Phoma rot, was general throughout the Winter Garden district, causing loss amounting to 2% (SSI).

Phytophthora parasitica (P. terrestris), buckeye rot, occurred generally throughout the Winter Garden district, loss averaging 1% (SSI). Buckeye rot was observed in Brazos County (WNE).

Pseudomonas solanacearum, bacterial wilt, was observed in Cherokee County (PAY).

Pseudomonas (Bacterium) tomato, bacterial speck, caused loss of 2% in Cherokee County (PAY).

Rhizoctonia solani, soil rot, caused 1% loss of fruit in Cherokee County (PAY).

Sclerotium rolfsii, southern blight, was generally distributed, but only occasionally serious in the fall of 1943 (GMW). It occurred generally throughout the Winter Garden district, causing loss of 5% (SSI).

A trace was observed in Bell County (EWL). In Cherokee County 80% loss was noted in one planting (PAY), and in Atascosa County 2% loss in one planting (HWL).

Stemphylium solani, gray leaf spot. A trace was observed in Dimmit County (SSI).

Heterodera marioni, affected all of the plants in a 3-acre field in Atascosa County (GMW). The disease occurred generally throughout the Winter Garden district, causing loss of 2%. It was especially prevalent near Quemado in Maverick County (SSI). Rootknot was noted on tomatoes in Kerr, Bexar, and Dallas Counties (AAD).

Curly top (virus) affected 1% of the plants in all fields examined in Dimmit, Webb, Maverick, and Hidalgo Counties (GMW). The disease was general and caused a loss of 1% throughout the Winter Garden district (SSI).

Mosaic (virus) caused 2% loss generally throughout the Winter Garden district (SSI). In Fort Bend County 50% loss was observed in one small planting (GMW). Traces of aucuba mosaic occurred in scattered fields throughout the Winter Garden district (SSI). Cucumber mosaic was general in the Winter Garden district, causing 1% loss (SSI).

Traces of the virus diseases spotted wilt and streak occurred throughout the Winter Garden district (SSI).

A trace of blossom-end rot (physiogenic) occurred generally throughout the Winter Garden district (SSI). Blossom-end rot was common in home plantings, averaging 3% loss, in Walker County (GMW).

Chlorosis (physiogenic) affected all plants in 10 acres observed in Zavala County (GMW). Chlorosis was noted in Johnson County (AAD).

Fruit pox (probably physiogenic) affected 50% of the fruits in one home planting examined in El Paso County (GMW). The disease was general throughout the Winter Garden district, causing 2% loss (SSI).

Shoulder blotch (nonparasitic) occurred in traces throughout the Winter Garden district (SSI).

Rosette (cause undetermined) was noted in Bowie County (AAD).

PHASEOLUS LUNATUS, LIMA BEAN. Rootknot (Heterodera marioni) was observed in Cass County (AAD).

PHASEOLUS VULGARIS, BEAN. Erysiphe polygoni, powdery mildew, was severe on susceptible varieties in variety trials in Dimmit County (GMW). The disease was generally distributed in the Winter Garden district where it caused 2% loss (SSI).

Fusarium spp., root rot. A trace occurred in scattered fields throughout the Winter Garden district (SSI).

Macrophomina phaseoli, ashy stem blight, occurred in numerous fields in Cameron and Hidalgo Counties, loss averaging 0.1% (GMW). The disease occurred in scattered fields in Dimmit County where the loss was 1% (SSI). In Hidalgo County the disease was observed on the Experiment Station and on various farms on the spring crop (GHG); 2% loss was noted in 2 fields in this county (HWL).

Phymatotrichum omnivorum, root rot, caused a loss of 1% in Bell County (EWL).

Pythium sp., stem blight. From a trace to 30% was observed in fields in Hidalgo County (GHG).

Rhizoctonia solani, stem and root rot, was observed causing 0.1% loss in numerous fields in Cameron and Hidalgo Counties. On 15 acres in Hidalgo County loss was 29% (GMW). From a trace to 2% loss resulted in Hidalgo County (GHG). The disease was noted in Victoria and Dallas Counties (AAD).

Sclerotium rolfsii, southern blight, caused 0.1% loss in numerous fields in Cameron and Hidalgo Counties (GMW). Southern blight was general throughout the Winter Garden district, loss averaging 3% (SSI). Losses ranging from a trace to 15% occurred in the fall crop in Hidalgo County (GHG). The disease was observed in Harris, Nolan, and Scurry Counties (AAD).

Uromyces phaseoli var. typica, rust, caused 25% loss in a planting of less than an acre in Smith County. It was severe on susceptible varieties on variety trials in Dimmit County (GMW). In one planting in Hidalgo County all leaflets were infected (HWL).

Xanthomonas phaseoli, bacterial blight, was observed in McLennan and San Patricio Counties (AAD).

Curly top (virus) occurred in scattered traces throughout the Winter Garden district (SSI).

Common mosaic (virus). Infection of 95% was observed in 40 acres in Dallam County; 1% infection was noted in 3 fields in Red River County; a trace occurred on 15 acres in Hidalgo County (GMW). The disease was general and caused 2% loss in the Winter Garden district (SSI).

Yellow mosaic (virus) caused a trace of loss in scattered fields throughout the Winter Garden district (SSI).

Chlorosis (nonparasitic) was universal in the Lower Rio Grande Valley following irrigation on alkaline soils (GMW).

PISUM SATIVUM, PEA. Erysiphe polygoni, powdery mildew, caused a 2% loss in Bell County (EWL).

SOLANUM MELONGENA, EGGPLANT. Phomopsis vexans, blight and fruit rot, caused significant losses in Atascosa and Maverick Counties (HWL). Phymatotrichum omnivorum, root rot, was observed in Brazos County (AAD). Sclerotium rolfsii, southern blight, was general in the Winter Garden district and caused a 3% loss (SSI).

Heterodera marioni, rootknot, caused 100% loss in one quarter-acre planting observed in El Paso County (GMW). Loss of 5% was noted in one field in Webb County. The disease was prevalent in the Winter Garden district (HWL).

Yellows (virus) was observed affecting 50% of the plants in a half-acre planting in Cherokee County, 100% of the plants in 2 home gardens in Houston County, 85% in 2 acres in Fort Bend County, from 11 to 70% in 3 fields in Atascosa County, and a trace in 1 field in Maverick County (GMW). The disease occurred generally throughout the Winter Garden district, loss amounting to 15% (SSI). An average of 10% infection was noted in fields examined in the Winter Garden district and the Lower Rio Grande Valley (HWL).

SOLANUM TUBEROSUM, POTATO. Actinomyces scabies, scab, was present in all production districts in the Panhandle, infected tubers ranging from 2 to 50% (GMW). It was severe in some fields in Cameron and Hidalgo Counties in the Lower Rio Grande Valley (GHG). It was observed in Hale and Floyd Counties (AAD).

Alternaria solani, early blight, was general but causing slight damage in several large fields examined in Lubbock, Bailey, Deaf Smith, and Dallam Counties in northwestern Texas and the Panhandle (GMW). In Cameron County it did not appear until the crop was practically made (GHG).

Bacillus sp., soft rot, was observed in Harris County (AAD).

Phytophthora infestans, late blight. A trace of infection was noted in Cameron County but development was stopped by dry weather (GHG).

A trace of Rhizoctonia solani was seen on tubers in graders in various parts of the Panhandle, and in several fields in Dallam County (GMW).

Sclerotium bataticola, charcoal rot, caused 3 to 4% loss in several fields examined in Lubbock County (GMW). In east Texas the disease caused 20% loss (RDW).

Sclerotium rolfsii, southern blight, was present in all production districts of the Panhandle, but infection was never more than a trace (GMW) Damage of 1% was noted in 1 field in Cherokee County (PAY).

Certain home gardens in Walker County in east Texas showed 100% infection by Heterodera marioni, rootknot (GMW).

Haywire (virus) was general in Smith County in east Texas, loss amounting to 2% (RDW).

Leaf roll (virus) was negligible in Hidalgo County on fields from northern certified seed. Use of locally grown seed one year from certified resulted in 48% infection (GHG).

Mosaic (virus) was general in Smith County where it caused 3% loss (RDW). A trace was noted in Dallam County (GMW).

Spindle tuber (virus) infected all tubers in 2 lots of White Rose examined, one in Lubbock County, the other in Floyd County (GMW).

SPINACIA OLERACEA, SPINACH. Albugo occidentalis, white rust, was widespread in Maverick County in the Winter Garden district, loss averaging 35% (HWL). Throughout the Winter Garden district generally loss averaged 15 to 25% (SSI). In the Robstown area the disease caused total loss in one field observed in Nueces County (GHG), and traces were observed in one field in Nueces County and another in San Patricio County (GMW).

Throughout the Winter Garden district, traces of anthracnose (Colletotrichum spinaciae) and leaf spot (Heterosporium variabile) were found in scattered fields, while wilt (Fusarium spinaciae) occurred generally, but also in trace amounts (SSI).

Peronospora effusa, downy mildew. A trace was observed in one field in Zavala County (GMW). The disease was general throughout the Winter Garden district, loss caused amounting to 10% (SSI). Downy mildew was abundant in Nueces and Hidalgo Counties (GHG). From a trace to 100% infection occurred in fields examined in Bexar, Dimmit, Frio, Maverick, and Uvalde Counties (HWL).

Aster yellows (virus) caused 40% loss in 130 acres examined in Maverick County (HWL).

Curly top (virus) affected less than 1% of the plants in 2 fields observed in Zavala County (GMW). The disease was general in the Winter Garden district, loss caused amounting to 2% (SSI & HWL).

Occasional plants affected by mosaic (virus) were noted in Maverick County (HWL).

Chlorosis (physiogenic) caused moderate damage in one field observed in Bexar County (GMW).

CEREALS, GRASSES, AND FORAGE CROPS

AVENA SATIVA, OATS. Mild attack of crown rust (Puccinia coronata) caused 2% loss in north-central Texas, while a trace was observed in the Rolling Plains region. Stem rust (P. graminis) occurred in like amounts in both regions (IMA). Loose smut (Ustilago avenae) caused a loss of 2% in Bell County (EWL). It was observed in north-central Texas (IMA)

CROTALARIA. Phymatotrichum omnivorum, root rot, caused 30% loss of stand of C. juncea in Bell County (EWL). In a 1-acre planting of C. spectabilis in Cherokee County, Sclerotium bataticola, charcoal rot, caused 100% loss (PAY).

HORDEUM VULGARE, BARLEY. Powdery mildew (Erysiphe graminis) was severe and caused 5% loss in north-central Texas. A trace of leaf rust (Puccinia anomala) occurred in that region (IMA).

MEDICAGO SATIVA, ALFALFA. Phymatotrichum omnivorum, root rot, caused from a trace to 5% loss in numerous fields observed in Reeves County (GMW). A loss of 50% occurred in Bell County (EWL).

Traces of Pseudopeziza medicaginis, leaf spot, were observed in numerous fields in El Paso, Reeves, Ward, Crane, and Pecos Counties (GMW).

Yellow leaf blotch (Pyrenopeziza medicaginis) caused slight damage in Hidalgo County (HWL).

Uromyces striatus, rust, occurred in trace amounts in numerous fields examined in El Paso, Reeves, Ward, Crane, and Pecos Counties (GMW). It was prevalent in Hidalgo County (HWL).

Girdling, attributed by some to insect injury, was observed in 3 fields in Ward County, where 5% of the plants were damaged (GMW). Loss of 5% resulted in Hidalgo County (HWL).

MELILOTUS, SWEETCLOVER. Phymatotrichum omnivorum, root rot, caused 20% loss of M. alba and M. alba var. annua in Bell County (EWL).

ORYZA SATIVA, RICE. Cercospora oryzae, leaf spot, was fairly abundant in Jefferson and Orange Counties. A trace was noted west of Houston. Entyloma oryzae, leaf smut, was ubiquitous on older rice leaves in the southeastern coastal belt but damage was slight. Helminthosporium oryzae, leaf spot, was common throughout the southeastern coastal section. Often the fungus attacked 3 to 5% of the florets. Piricularia oryzae, blast, occurred throughout the southeastern coastal belt, but never more than a trace was seen. Straighthead (physiogenic) was serious and caused nearly complete loss of the crop in a few fields in Orange County (GMW).

SESAMUM INDICUM, SESAME. Bacterium sesamicola, foliage and stem blight, caused serious injury in experimental plantings in Denton, Bell, and Brazos Counties (GMW). In Bell County a 4% loss was caused (EWL).

SOJA MAX, SOYBEAN. Macrophomina phaseoli, ashy stem blight, was severe in the spring in plantings at the Experiment Station in Hidalgo County (GHG). Phymatotrichum omnivorum, root rot, occurred on soybean in trace amounts in Bell County (EWL). Pseudomonas glycinea, bacterial blight, caused slight injury in experimental plantings in El Paso County; while Xanthomonas phaseoli var. sojense, bacterial pustule, caused complete defoliation of most varieties in experimental plantings in Hardeman and Denton Counties (GMW).

SORGHUM VULGARE, SORGHUM. Leaf blight (Helminthosporium turcicum) was severe in one large field in Zavala County (GMW). Leaf stripe (Pseudomonas andropogoni) was common on susceptible varieties throughout the coastal plain (GMW). In one experimental planting in Hardeman County, root rot (Pythium arrhenomanes) caused moderate damage on susceptible varieties (GMW). Charcoal rot (Sclerotium bataticola) caused moderate damage to milos in Hardeman County (ECT). A trace of covered smut (Sphacelotheca sorghi) was noted in Bell County (EWL).

STENOTAPHRUM SECUNDATUM. Leaf spot (Piricularia sp.) and brown patch (Rhizoctonia sp.) were common in Hidalgo County (GHG).

TRITICUM AESTIVUM, WHEAT. A trace of powdery mildew (Erysiphe graminis) occurred in wheat fields in north-central Texas (IMA). Stem rust (Puccinia graminis) caused 10% loss in Bell County (EWL). A trace occurred in north-central Texas in the spring (IMA). Heavy fall infection by leaf rust (P. rubigo-vera var. tritici) was observed in north-central Texas and the rolling plains and panhandle regions, and severe development in the spring caused 5% loss in the north-central area (IMA). Speckled leaf blotch (Septoria tritici) was severe and caused 2% loss in north-central Texas, while a trace occurred in the rolling plains area (IMA). Traces of loose smut (Ustilago tritici) were observed in north-central Texas and the rolling plains (IMA).

VIGNA SINENSIS, COWPEA. Leaf spot (Cercospora cruenta) occurred generally in central, east, and southern Texas, causing losses up to 10% (GMW). Powdery mildew (Erysiphe polygoni) was observed in one field in Kendall County, where all plants were heavily attacked(GMW). Wilt (Fusarium spp.) caused 3 to 15% loss in 2 plantings observed in Atascosa County (HWL). Ashy stem blight (Macrophomina phaseoli) occurred in trace amounts in one field in Hidalgo County, and 2% loss was noted in a 2-acre planting in Cameron County (GMW). The disease was observed in Cherokee County (PAY). A loss of 2% resulted from root rot (Phymatotrichum omnivorum) in Bell County (EWL). Stem rot (Rhizoctonia solani) caused less than 1% loss in fields examined in Webb and Hidalgo Counties (HWL). Southern blight (Sclerotium rolfsii) caused loss of 2% in Atascosa County (HWL). Rust (Uromyces phaseoli var. vignae) was severe in several fields in Hidalgo County (GMW), and in a 2-acre planting in Cameron County and caused slight loss in fields observed in Atascosa County (HWL).

Crown canker (pathogen described as Xanthomonas vignicola n. sp. by Burkholder, Phytopath. 34: 430-432, Apr. 1944), was observed as follows: 95% of the plants affected in 4 fields in Kendall County; 60% affected in 1 field in Dimmit County; 10% in several fields in Hidalgo County; 25% in 1 field in Houston County; 25% in several fields in Cherokee and Smith Counties (GMW).

A trace of mosaic (virus) was noted in occasional fields in east Texas, and 90% loss in a 3- to 4-acre planting in Fort Bend County (GMW). The disease was observed in Harris and Dallas Counties (AAD).

ZEA MAYS, CORN. Traces of ear rot due to Diplodia zeae occurred in Bell County (EWL), and occurrence of the disease was noted in Comal, Burnet, and Falls Counties (AAD). Leaf blight (Helminthosporium turcicum) was scarce this year in Hidalgo County (GHG). Smut (Ustilago maydis) (U. zeae) affected 10% of the ears in 1 field in El Paso County and 50% of the ears in one in Camp County (GMW). A trace occurred in Bell County (EWL). In one fall planting in Cherokee County 75% of the ears were smutted, but the disease was rare in the spring (PAY). The meadow nematode (Pratylenchus pratensis) caused severe damage in Cherokee County (PAY).

FRUIT AND NUT CROPS

AMYGDALUS PERSICA, PEACH. Traces of brown rot (Monilinia fructicola) (Sclerotinia americana) occurred in Bell County (EWL). A trace of bacterial spot (Xanthomonas pruni) was observed in one orchard in Erath County (GMW). Rootknot (Heterodera marioni) was noted on peach in Kendall County (AAD). Chlorosis (physiogenic) caused 10% loss in Bell

County (EWL), and occurrence was noted in Bexar and Travis Counties (AAD).

CARYA ILLINOENSIS, PECAN. *Cladosporium effusum*, scab, caused slight damage in 1 home planting in Tyler County and to native trees in woods in Matagorda County (GMW). Rosette (nonparasitic) was observed in Menard County (AAD).

CITRUS spp. A trace of fruit rot caused by *Alternaria citri* was observed in 1 orchard in Dimmit County (GMW). Melanose (*Diaporthe citri*) occurred in traces in 1 orchard in Dimmit County (GMW); there was much less in Cameron County than for 2 years previously (GHG). Up to 50% of stem-end rot (*Diplodia natalensis*) occurred in shipments from the Lower Rio Grande Valley (GHG). Only light attacks of scab (*Elsinoë fawcetti*) were noted in the Valley this year (GHG). Blue mold (*Penicillium* sp.) occurred throughout the Winter Garden district where it caused from 5 to 10% loss, and chlorosis (nonparasitic) was general in this district, loss due to it being estimated at 2% (SSI).

FICUS CARICA, FIG. A trace of root rot (*Phymatotrichum omnivorum*) was observed in Bell County (EWL). Rust (*Physopella fici*) caused 5% loss in 1 orchard examined in Brazoria County and 10% in several orchards in Galveston and Harris Counties (GMW); it was observed in Jim Hogg County (AAD). Rootknot (*Heterodera marioni*) was noted on fig in Dallas County (AAD).

FRAGARIA, STRAWBERRY. A trace of leaf scorch (*Diplocarpon earliana*) was noted in 1 small planting in Smith County and another in Atascosa County (GMW). Leaf spot (*Mycosphaerella fragariae*) occurred in traces in 1 small planting in Cherokee County (GMW); it was scattered throughout the Winter Garden district where it caused 2% loss (SSI). In Dimmit County, summer dwarf (*Aphelenchoides* sp.) caused 100% loss in one small planting (GMW) and 50% loss in local areas (SSI). Rootknot (*Heterodera marioni*) occurred generally on strawberries throughout the Winter Garden area, where it caused 15% loss (SSI).

MALUS SYLVESTRIS, APPLE. Many galls due to *Agrobacterium tumefaciens* were observed on the upper limbs and top of a tree 5 feet tall in Cherokee County (PAY). Fireblight (*Erwinia amylovora*) caused 10% loss in a home orchard in El Paso County (GMW). Bitter rot (*Glomerella cingulata*) was observed in Morris and Smith Counties, and blackrot (*Physalospora obtusa*) in Menard County (AAD).

PRUNUS spp. Crown gall (*Agrobacterium tumefaciens*) was observed in Bexar County (AAD). Bacterial spot (*Xanthomonas pruni*) caused a trace of damage in one orchard in Atascosa County, and serious injury in one in Jasper County (GMW).

PYRUS COMMUNIS, PEAR. A trace of infection by leaf spot (*Cercospora minima*) occurred in 1 nursery in Shelby County (GMW). Fireblight (*Erwinia amylovora*) was common in home orchards throughout central and east Texas, but damage was usually moderate (GMW). Moderate damage was observed in 1 home orchard in El Paso County (GMW). In Bell County 2% loss was noted (EWL). Black rot (*Physalospora obtusa*) was observed in Jefferson County (AAD).

RUBUS spp., CANE FRUITS. *Agrobacterium tumefaciens*, crowngall, was general and caused 2% loss in east Texas (RDW). *Gymnoconia peckiana* (*G. interstitialis*), rust, was common in Cherokee County (PAY), and caused 3% loss in east Texas (RDW). *Mycosphaerella rubi*, leaf spot, occurred in east Texas (RDW).

VITIS spp., GRAPE. *Guignardia bidwellii*, black rot, was general

throughout the Winter Garden district where it caused 10% loss (SSI), and occurrence was noted in Harris County (WNE). *Plasmopara viticola*, downy mildew, was general and caused a trace of loss in Dimmit County (SSI); it occurred in Harris County (WNE). *Sphaceloma ampelinum*, anthracnose, caused a trace to 7% loss in Dimmit County (SSI). "California disease" (virus), caused 75% loss in local areas in Dimmit County (SSI).

SPECIAL CROPS

ARACHIS HYPOGAEA, PEANUT. Leaf spot caused by *Mycosphaerella arachidicola* began showing up in east Texas in August, and considerable defoliation occurred in some fields in that area in September (GMW). The disease was mild in Cherokee County this year (PAY). *Mycosphaerella berkeleyii* was general in all peanut sections, showing up in September and causing serious defoliation in many fields in October and November (GMW)

Charcoal rot (*Sclerotium bataticola*) caused a trace of damage in one field in Waller County and another in Atascosa County (GMW).

Southern blight (*S. rolfsii*) was general in all peanut areas, causing from 1 to 2% loss in some fields (GMW). It was observed in Cherokee County (PAY), Atascosa, Bexar, Gonzales, and Bell Counties (AAD), Franklin County (GMW).

CARTHAMUS TINCTORIUS, SAFFLOWER. Blight due to *Gloeosporium* sp. caused a loss of 30% in Bell County (EWL).

GOSSYPIUM, COTTON. Only a trace of leaf spot (*Cercospora althaeina*) was observed in occasional fields in eastern and central Texas (GMW).

Fusarium wilt (*F. oxysporum* f. *vasinfectum*) was generally distributed in east Texas, loss ranging up to 10% in some cases. In Washington County 100% infection was observed on 1 acre; in Lee County 5% on 20 acres (GMW). Wilt was observed in Polk County (AAD).

Leaf spot caused by *Macrosporium nigricantium* was uniformly severe in numerous fields seen in El Paso and Hudspeth Counties, and was generally distributed but not severe in numerous fields examined in Reeves, Loving, Ward, Crane, and Pecos Counties (GMW).

Root rot (*Phymatotrichum omnivorum*) caused less than the usual amount of damage in the heavy black soils of north, central, and south Texas. Losses were heavy (up to 75% killing of plants) in Nueces, San Patricio, and Jim Wells Counties, while slight loss was observed in a few fields in Cherokee County and 1 field in Hidalgo County, and a trace in most fields in Hudspeth, Reeves, Ward, Crane, and Loving Counties (GMW). The disease occurred locally in Maverick County, resulting in 5% loss (SSI). Attack in the Lower Rio Grande Valley was light this year (GHG). Loss of 20% occurred in Bell County (EWL).

Rust (*Puccinia stakmanii*) (P. schedonnardi) was seen in one field in El Paso County in October. The disease was said to have been general and severe in the El Paso Valley during August (GMW, AAD).

Verticillium wilt (*V. albo-atrum*) was generally distributed in El Paso and Hudspeth Counties, occurring in many fields and causing up to 50% loss in some places. Traces were observed in many fields in Reeves, Ward, Loving, Crane, and Pecos Counties (GMW).

Angular leaf spot (*Xanthomonas malvacearum*) was seen in all fields in central, north, east, and south Texas, but was nowhere severe. The organism was rarely seen on bolls (GMW). Local occurrence in Maverick

County resulted in 1% loss (SSI). A trace was observed in Bell County (EWL).

Rootknot (Heterodera marioni) was observed causing from a trace to 10% loss in several fields in Nacogdoches and Shelby Counties, and 100% of the plants were attacked in a 1-acre field in Washington County (GMW).

HIBISCUS SABDARIFFA, ROSELLE. Southern blight (Sclerotium rolfsii) caused 10% loss in 1 small experimental planting in Hidalgo County (GMW).

PARTHENIUM ARGENTATUM, GUAYULE. Root rot (Phymatotrichum omnivorum) killed 5% of the plants in a 1-acre planting in Reeves County (GMW), and was abundant in some fields in Hidalgo County (GHG). Crown rot, caused by Phytophthora sp.(according to John T. Presley in verbal communication), killed 10% of the plants in a 1-acre planting in El Paso County (GMW).

RICINUS COMMUNIS, CASTOR BEAN. Leaf spot (Alternaria sp.) was abundant in Hidalgo County in the fall (GHG). Root rot (Phymatotrichum omnivorum) caused a trace of damage in Bell County (EWL).

SACCHARUM, SUGARCANE. Mosaic (virus) occurred generally in small home plantings in east Texas (GMW); in Cherokee County 100% infection was noted in 1 field (PAY).

TARAXACUM KOK-SAGHYZ, KOK-SAGHYZ. Rootknot (Heterodera marioni) was prevalent in plantings of this plant on the Experiment Station in Hidalgo County (GHG).

MISCELLANEOUS PLANTS

ABELIA GRANDIFLORA. A trace of chlorosis (nonparasitic) was noted in Bell County (EWL).

CAMELLIA sp. Bud drop (physiogenic) occurred in San Patricio and Aransas Counties (AAD)

CARYA sp. (probably C. BUCKLEYI). Witches'-broom caused by Microstroma juglandis was observed in Smith County (WNE).

CELTIS sp. Limb canker (Septobasidium sydowii) occurred in Bell County (EWL).

CUPRESSUS ARIZONICA. Conifer blight (cause undetermined) was noted in Dallas and Tarrant Counties (AAD, WNE).

EUONYMUS sp. Powdery mildew (Microsphaera alni) occurred in Tom Green and Falls Counties (AAD). Root rot (Phymatotrichum omnivorum) caused 30% loss of plants in Bell County (EWL).

GARDENIA JASMINOIDES. Chlorosis (nonparasitic) caused 5% loss in Bell County (EWL), and was observed in Refugio and Orange Counties (AAD).

GLADIOLUS spp. Leaf and crown rot caused by Rhizoctonia solani was serious at Linn in Hidalgo County (GHG). Dry rot (Sclerotinia gladioli) was observed in Harris County, and bacterial corm decay in Tarrant County (AAD).

IRIS spp. Sclerotium rolfsii, southern blight, was plentiful in Hidalgo County, and basal rot due to Aphelenchoides parietinus also occurred abundantly (GHG).

JUNIPERUS spp. Rust (Gymnosporangium exiguum)was observed in Harris County, and an undetermined conifer blight in Oldham, Young, and Dallas Counties (AAD).

LAGERSTROEMIA INDICA. A trace of powdery mildew (Erysiphe sp.) and 1% damage by nonparasitic chlorosis were observed in Bell County (EWL).

LIGUSTRUM sp. Root rot (Phymatotrichum omnivorum) was observed in

Bell (EWL) and Hidalgo (WNE) Counties, and chlorosis (nonparasitic) in Bell County (EWL).

LILIUM LONGIFLORUM. Bulb rot due to Rhizopus sp. caused considerable loss of stocks for planting in Hidalgo County (GHG).

MAGNOLIA sp. Chlorosis (nonparasitic) occurred in Galveston County (AAD).

NANDINA DOMESTICA. Chlorosis (nonparasitic) was observed in Bell County (EWL), and an undetermined root gall in Bee County (AAD).

PHOENIX spp. Graphiola phoenicis, false smut, was ubiquitous but caused minor damage to P. canariensis in Hidalgo County and P. dactylifera in Dimmit and Hidalgo Counties (GMW), and was observed on the latter species in Nueces County (AAD).

PLUMERIA RUBRA f. TRICOLOR. Root rot (Phymatotrichum omnivorum) occurred in Hidalgo County (WNE).

PYRACANTHA sp. Chlorosis (nonparasitic) was observed in Dallas County (AAD)

QUERCUS VIRGINIANA. Twig blights caused by Coryneum kunzei and Diplodia longispora were observed in Jefferson County (WNE), and blister leaf (Taphrina caerulescens) in McLennan County (AAD).

ROSA spp. Infection by black spot (Diplocarpon rosae) averaged 10% in Bell County (EWL); was observed in Swisher County (AAD); and caused 25% reduction in growth in east Texas (RDW). In Bell County powdery mildew (Sphaerotheca pannosa) caused 1% loss (EWL); the disease was also observed in Hall County (WNE). Root rot (Phymatotrichum omnivorum) caused 2% loss in Bell County; in the same county an undetermined stem canker caused 1% loss and nonparasitic chlorosis 5% (EWL).

SCHINUS MOLLE. Root rot (Phymatotrichum omnivorum) was observed attacking pepper tree in Webb County (WNE).

SPIRAEA sp. Chlorosis (nonparasitic) occurred in Bell County (EWL)

THUJA sp. Chlorosis (nonparasitic) caused 2% loss of plants in Bell County (EWL).

PLANT DISEASES IN MONTANA IN 1943

Hubert A. Harris

This report represents a summary of the more important plant diseases observed in Montana during 1943. The observations were obtained during survey activities extending from August 11 to September 26 and are supplemented by data provided by Collaborator H. E. Morris, pathologist of the Montana Agricultural Experiment Station.

VEGETABLE CROPS

BRASSICA OLERACEA var. CAPITATA, CABBAGE. Fusarium oxysporum f. conglutinans (F. conglutinans) (yellows) was of occasional prevalence. In Ravalli County a medium severity was noted on a trace of the plants.

CUCUMIS SATIVUS, CUCUMBER. Erwinia tracheiphila (wilt) was of general distribution. Observations in Ravalli County indicated heavy severity on a trace to 1% of the plants.

LACTUCA SATIVA, LETTUCE. Sclerotinia sclerotiorum (drop) was of general occurrence. In Ravalli County severity was medium on a trace of the plants.

LYCOPERSICON ESCULENTUM, TOMATO. Corynebacterium michiganense (bacterial canker) was of occasional prevalence. Severity ranging from light to medium on 10% of the plants was observed in Ravalli County.
Fusarium oxysporum f. lycopersici (F. bulbigenum var. lycopersici) (wilt) was of general distribution. Medium severity on a trace of the plants was noted in Missoula County.
PHASEOLUS VULGARIS, BEAN. Fusarium solani f. phaseoli (F. solani var. martii) (root rot) was prevalent in small amounts in nearly all commercial plantings. Pseudomonas medicaginis var. phaseolicola (halo blight) was of general distribution in garden plantings. The Great Northern commercial bean is resistant to the disease. Uromyces phaseoli var. typica (rust) was of general distribution but injury was slight owing to late occurrence. Observations in Treasure and Yellowstone Counties showed medium severity of 65% of the plants. Xanthomonas phaseoli (common blight) occurred in small amounts in occasional fields. Mosaic (virus) commonly occurred in the ordinary selections of Great Northern beans. Idaho 81 and Idaho 123 selections of this variety are highly resistant to mosaic and comprise the chief commercial acreage.
PISUM SATIVUM, PEA. Aphanomyces euteiches (root rot) was of general distribution. In Gallatin County a medium severity on 10 to 15% of the plants was observed. Erysiphe polygoni (powdery mildew) was of general prevalence during the latter part of the season. Medium severity on 98% of the plants was observed in Missoula County. Injury was considered slight owing to the late occurrence. Pseudomonas pisi (bacterial blight) was of occasional prevalence and particularly in fields injured by hail or storm. Light severity on 2% of the plants was noted in Gallatin County.
SOLANUM TUBEROSUM, POTATO. Actinomyces scabies (scab) was of general distribution on susceptible varieties in small amounts. Corynebacterium sepedonicum (ringrot) was of general prevalence in small amounts. Light severity on 2% of the plants was noted in the Bitterroot Valley. Erwinia phytophthora) (E. carotovora) (blackleg) was approximately of the same distribution as ringrot. It occurred in small amounts, particularly in low and poorly drained soils. In the Bitterroot Valley medium severity was observed on 5% of the plants. Rhizoctonia solani was of general distribution in small amounts.

CEREAL AND FORAGE CROPS

AVENA SATIVA, OATS. Puccinia graminis var. avenae (stem rust) was general in the northeastern section of the State. Data obtained in Richland, Sheridan, Valley, and Yellowstone Counties showed a severity ranging from 5 to 40% on 15 to 85% of the plants. The estimated average was 25% severity on 65% of the plants.
Ustilago avenae and U. kolleri (U. levis) (loose and covered smuts) were of general prevalence where seed treatment was not practiced. In Sheridan County a severity of 10% was observed.
HORDEUM VULGARE, BARLEY. Claviceps purpurea (ergot) was of occasional occurrence. It was observed in Gallatin County as a trace with medium severity.
Helminthosporium gramineum (stripe) was of general distribution. Observations in Blaine, Gallatin, and Phillips Counties showed that severity ranged from a trace to heavy on a trace to 95% of the plants. The

estimated average was medium severity on 65% of the plants.

Puccinia graminis (stem rust) was prevalent chiefly in the northeastern section of the State. Data secured from Roosevelt and Valley Counties indicated that severity ranged from 2 to 25% on 5 to 10% of the plants. The estimated average was 15% severity on 5% of the plants.

Ustilago jensenii (U. hordei)(covered smut) was general in its distribution, and observations in Fergus, Gallatin, Hill, Roosevelt and Valley Counties indicated a severity ranging from a trace to 1%.

Ustilago nuda (loose smut) was occasional in distribution and severity was even less than that of covered smut.

Xanthomonas translucens (bacterial blight) was observed as a trace with medium severity in Fergus County.

LINUM USITATISSIMUM, FLAX. Melampsora lini (rust) was of general distribution. Data obtained in Choteau, Dawson, Phillips, Richland, Roosevelt, and Sheridan Counties showed a severity ranging from light to heavy on 25 to 98% of the plants. The estimated average was heavy on 75% of the plants. Damage to the seeds was doubtful. Mycosphaerella linorum (Phlyctaena linicola) (pasmo) was occasional with light severity in the northeastern section of the State. Heat canker (nonparasitic) was of general distribution with light severity.

MEDICAGO SATIVA, ALFALFA. Ascochyta imperfecta (blackstem disease) was observed in Stillwater County with heavy severity of 65% of the plants.

Pseudopeziza medicaginis (leaf spot) was of general prevalence. Observations recorded in Custer, Choteau, Fergus, Gallatin, Phillips, Richland, Stillwater, Sweetgrass, and Yellowstone Counties indicated a severity ranging from light to very heavy on 10 to 98% of the plants. The estimated average was medium severity on 90% of the plants.

Pyrenopeziza medicaginis (leaf blotch) was of general occurrence. Data obtained in Custer, Choteau, Gallatin, Phillips, Stillwater, Sweetgrass, and Yellowstone Counties showed a severity varying from light to heavy on 2 to 50% of the plants. The estimated average was medium severity on 15% of the plants.

Winter injury was more or less general. Injury was more severe in the western third of the State and particularly severe in Gallatin County.

SECALE CEREALE, RYE. Claviceps purpurea (ergot) was of general distribution but more severe in the eastern 2/3 of the State. Light severity on a trace of the plants was observed in Roosevelt County.

TRITICUM AESTIVUM, WHEAT. Puccinia graminis var. tritici (stem rust) was of general distribution but more prevalent in the eastern 2/3 of the State. There was no appreciable loss to the wheat crop. In Dawson, Fergus, Roosevelt, Sheridan, and Valley Counties a severity ranging from 2 to 25% on 2 to 25% of the plants was observed. The estimated average was 10% severity on 10% of the plants.

P. rubigo-vera var. tritici (leaf rust) was of general prevalence on spring wheat. In Gallatin, Roosevelt, Sheridan, and Valley Counties, severity varied from 5 to 40% on 10 to 85% of the plants. The estimated average was 20% severity on 65% of the plants.

Tilletia foetida (T. levis) and T. caries (T. tritici) (bunt) was of general distribution and more prevalent on winter wheat than spring wheat. Severity ranged from a trace to 1% in Choteau, Fergus, Roosevelt, and Sweetgrass Counties.

ZEA MAYS, CORN. Ustilago maydis (U. zeae) was of general prevalence and chiefly as a trace as observed in Blaine, Dawson, Gallatin, Phillips,

Richland, and Yellowstone Counties.

FRUIT CROPS

FRAGARIA, STRAWBERRY. Various fungi causing leaf spots were of general distribution but of slight importance. Medium severity on 50% of the plants was observed in Missoula and Ravalli Counties. Yellows (hereditary leaf variegation) was of general prevalence on the everbearing Progressive berry. Medium severity on 1% of the plants was observed in Ravalli County.

MALUS SYLVESTRIS, APPLE. Erwinia amylovora (fireblight) was generally prevalent throughout the apple areas, chiefly as a trace with light to medium severity.

Venturia inaequalis (scab) was of general occurrence in the Flathead Lake and Bitterroot Valley regions. The severity was correlated proportionately to the spray applications practiced, sprayed orchards showing only a trace of the disease. Unsprayed orchards were infected almost 100% and severity ranged from light to heavy on 5 to 90% of the leaves. Severity was light to heavy on 5 to 75% of the fruits. The estimated average was medium severity on 50% of the leaves and medium severity on 25% of the fruits.

Drought spot (physiogenic) occurred occasionally in the Flathead Lake and Bitterroot Valley areas. Severity was medium to heavy on 1 to 25% of the fruits. The estimated average was medium severity on 10% of the fruits.

Jonathan spot (physiogenic) was of occasional occurrence. One orchard in the Flathead Lake vicinity showed light to medium severity on 10% of the fruits of 50% of the trees.

PRUNUS AVIUM, SWEET CHERRY, and P. CERASUS, SOUR CHERRY. Coccomyces hiemalis (leaf spot) was of general prevalence. In the Flathead Lake and Bitterroot Valley regions, severity ranged from a trace to light on a trace to 5% of the leaves of 25 to 90% of the trees. The estimated average was light severity on 2% of the leaves of 50% of the trees. Sweet cherries had a lesser amount of infection than sour cherries.

Podosphaera oxyacanthae (powdery mildew) was of occasional prevalence in the Flathead Lake vicinity. A medium severity on 2% of the leaves of 5% of the trees was noted.

Winter injury caused a loss of approximately 90% of the cherries this year in the Flathead Lake area.

PYRUS COMMUNIS, PEAR. Venturia pyrina (scab) was of occasional prevalence. Light severity on a trace of the leaves and fruits of 10% of the trees was observed in the Bitterroot Valley

SPECIAL CROPS

BETA VULGARIS, SUGAR BEET. Cercospora beticola (leaf spot) occurred chiefly in Richland County with severity medium to heavy on 50 to 95% of the plants. The estimated average was heavy on 75% of the plants. Curly top (virus) was of general prevalence and occurred chiefly as a trace in Blaine, Phillips, Richland, and Yellowstone Counties. Various soil fungi (seedling "black roots") were of general distribution and of heavy severity. Nitrogen deficiency was more or less generally prevalent in the beet areas of Carbon and Yellowston Counties. Phosphate

deficiency was observed in rotation plots at the U. S. Huntley Field Station. Its occurrence was occasional since the use of a phosphate fertilizer is a standard agronomic practice by many beet growers.

SUMMARY OF PLANT DISEASES IN WYOMING FOR 1943

E. W. Bodine

This report was prepared with the assistance of the following collaborators: G. H. Starr, Pathologist, Wyoming Agricultural Experiment Station, University of Wyoming, and E. A. Lungren, Pathologist, Bureau of Entomology and Plant Quarantine, U. S. Department of Agriculture, Fort Collins, Colorado.

VEGETABLE CROPS

CAPSICUM FRUTESCENS, PEPPER. Alternaria sp. causing fruit rot was observed in victory gardens in Worland in Washakie County but loss caused was only a trace.

LYCOPERSICON ESCULENTUM, TOMATO. A few plants were found infected with a streak and ringspot type of virus disease near Thermopolis in Hot Springs County. Blossom-end rot (physiogenic) was observed causing a trace of loss in a victory garden in Worland, Washakie County.

PHASEOLUS VULGARIS, BEAN. Fusarium solani f. phaseoli, dry root rot, was general over the entire State. It was most prevalent this year in Big Horn and Washakie Counties. Loss caused amounted to 0.5%.

Pseudomonas (Phytomonas) medicaginis var. phaseolicola, bacterial halo blight, was general in Albany, Big Horn, Goshen, Hot Springs, Park, Sheridan, and Washakie Counties; loss was 0.3%. Xanthomonas (Phytomonas) phaseoli, common bacterial blight, occurred in the same areas as the halo blight, causing 0.2% loss.

Sclerotinia sclerotiorum, white mold, was noted in Big Horn, Park, and Washakie Counties, causing a trace of loss.

Uromyces phaseoli var. typica, rust, occurred in scattered locations in Big Horn, Goshen, Sheridan, and Washakie Counties. The heaviest infection noted was in the Clark Fork area in Park County. Total loss caused was a trace.

Curly top (virus) was observed in Fremont and Sheridan Counties; loss was a trace.

Mosaic, of green and yellow types (virus), was general over the entire State and caused 1.5% loss.

The red-node virus disease was scattered in occurrence in Park and Washakie Counties. Loss was a trace.

PISUM SATIVUM, PEA. Erysiphe polygoni, powdery mildew, was scattered in Albany, Park, and Washakie Counties; loss was a trace. Fusarium solani f. pisi (F. martii var. pisi), root rot, was observed causing a trace of loss in Park County. Uromyces fabae, rust, was observed on the Experiment Station Farm at Laramie.

SOLANUM TUBEROSUM, POTATO. Diseases of general occurrence throughout the State, with estimates of losses caused, were: Actinomyces scabies, scab, 2%; Alternaria solani, early blight, 0.5%; Corynebacterium sepedonicum, ringrot, 2%; Erwinia phytophthora (E. atroseptica), 0.5%; Fusarium

solani f. eumartii, wilt, with 1.5%; F. oxysporum, wilt, 1%; Rhizoctonia solani, with 1%; and the virus diseases, hay-wire with 0.5%; leaf roll, 1%; mosaic, 0.5%; and spindle tuber, 0.7%.

Psyllid yellows, induced by the psyllid, Paratrioza cockerelli, was scattered over the entire State, and caused 0.5% loss.

TRAGOPOGON PORRIFOLIUS, SALSIFY. Albugo tragopogonis, white rust, was noted in trace amounts in Albany and Washakie Counties.

CEREALS

AVENA SATIVA, OATS. Pseudomonas (Phytomonas) coronafaciens, halo-blight, was observed on the Experiment Station Farm at Laramie in Albany County. Puccinia coronata, crown rust, P. graminis var. avenae, stem rust, Ustilago avenae, loose smut, and U. kolleri (U. levis), covered smut, were general over the entire State. Percentage losses in 1943 were estimated as: crown rust, 0; stem rust 0.5; loose smut, a trace; and covered smut 1.

HORDEUM VULGARE, BARLEY. Claviceps purpurea, ergot, and Helminthosporium sativum, were observed on the Experiment Station Farm at Laramie in Albany County. Loss from each was a trace. Helminthosporium gramineum, stripe, was observed in Albany, Fremont, Goshen, Laramie, and Platte Counties, causing only a trace of loss.

Puccinia anomala (P. simplex), leaf rust, and P. graminis var. tritici, stem rust, were both scattered in distribution in Albany, Fremont, Goshen, Laramie, and Platte Counties. Each caused a trace of loss.

Ustilago jensenii (U. hordei), covered smut, and U. nuda, loose smut, were general over the entire State. Loss estimates were a trace for covered smut and 0.5% for loose smut.

MEDICAGO SATIVA, ALFALFA. Corynebacterium insidiosum, bacterial wilt, was general over the entire State and caused loss estimated at 5%.

Peronospora trifoliorum, downy mildew, occurred in the western and eastern parts of Wyoming; loss was a trace.

Pseudopeziza medicaginis, leaf spot, was general but caused a trace of loss.

SECALE CEREALE, RYE. Puccinia graminis var. secalis, stem rust, was scattered over the State; no loss was caused.

TRITICUM AESTIVUM, WHEAT. Erysiphe graminis var. tritici, powdery mildew and Helminthosporium sp. causing foot rot, were general over the entire State, and loss from each was a trace.

Puccinia graminis var. tritici, stem rust, was scattered in occurrence in the winter wheat areas in the State and loss ranged from none to a trace; while in the spring wheat areas occurrence was general and resulted in losses of a trace to 0.5%. Infection by P. rubigo-vera var. tritici (P. triticina), leaf rust, was scattered in both winter wheat areas and spring wheat areas in the State and losses to both ranged from none to a trace.

Tilletia foetida (T. laevis) and T. caries (T. tritici), bunt, occurred in Albany, Goshen, and Laramie Counties, the former causing 0.5% loss, the latter a trace.

Ustilago tritici, loose smut, was scattered over the wheat areas in the State. Loss was a trace.

ZEA MAYS, CORN. Fusarium moniliforme, ear rot; Fusarium sp., seedling blight and Ustilago maydis (U. zeae), smut, were all generally distributed over the entire State. Losses estimated were a trace from ear rot, 1% from seedling blight, and 3% from smut.

MISCELLANEOUS CROPS

BETA VULGARIS, SUGAR BEET. Cercospora beticola, leaf spot, was general in Big Horn, Goshen, Hot Springs, Sheridan, and Washakie Counties. Loss was estimated at a trace. Fusarium sp., root rot was general in Big Horn, Fremont, Goshen, Hot Springs, Sheridan and Washakie Counties. Loss averaged 1%. Pythium sp., Rhizoctonia solani, and Fusarium sp. causing damping-off and black root, were general in the sugar beet areas of the State. Loss was 0.5%. Rhizoctonia solani causing crown rot and root rot, was general in Big Horn, Fremont, Goshen, Hot Springs, Sheridan and Washakie Counties; loss averaged 1%. Curly-top (virus), occurred in Big Horn, Fremont, Hot Springs, Johnson, Sheridan and Washakie Counties, causing a trac of loss. Mosaic (virus) was scattered in the sugar beet districts of the State. Loss was a trace.

MALUS SYLVESTRIS, APPLE. Erwinia amylovora, Fireblight, was general ove the entire State and caused 4% loss.

SUMMARY OF PLANT DISEASES IN COLORADO FOR 1943

E. W. Bodine

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VEGETABLE CROPS

ALLIUM CEPA, ONION. Botrytis allii, neck rot, was observed in Crowley, Otero, and Pueblo Counties, occurring mostly as a storage trouble. Storage loss in 1942 amounted to 3%; for 1943 it is not yet determined. A trace of infection occurred in the field.

Fusarium oxysporum f. cepae (F. zonatum), basal bulb rot, was general over the entire State in the onion-growing districts; loss amounted to 0.2

Alternaria (Macrosporium) porri, purple blotch, occured in Crowley, Otero, and Pueblo Counties, where it was very prevalent. Storage loss in 1942 was 5%. Field infection in Otero and Pueblo Counties in 1943, was heavy, while in Morgan County it was slight. Storage loss for 1943 is undetermined.

Peronospora destructor (P. schleideni), downy mildew, was observed at Littleton in Arapahoe County but caused no loss.

Phoma terrestris, pink root, occurred in Arapahoe, Delta, Montrose, and Otero Counties and caused a trace of loss.

Urocystis cepulae, onion smut, was found in Weld County; loss was a trac

APIUM GRAVEOLENS, CELERY. Cercospora apii, early blight, occurred in Adams, Arapahoe, Denver, Fremont, Jefferson, and Pueblo Counties and resulted in loss of a trace. Erwinia carotovora, soft rot, was observed in Denver, Jefferson, and Larimer Counties. Loss in the field in 1943 was a trace. Fusarium oxysporum f. apii, Fusarium yellows, occurred in Adams, Arapahoe, Denver, Fremont, Jefferson, and Pueblo Counties and caused 0.5% loss in 1943. Pythium debaryanum, damping-off, was general in seedbeds. The highest loss was recorded in Adams and Fremont Counties. Sclerotinia sclerotiorum, pink rot, occurred in Adams, Arapahoe, Denver, Fremont, and Jefferson Counties. In 1942, trenched Pascal celery suffered 10% loss. The loss in 1943 is not determined. Septoria apii, late blight, was common in all celery growing districts in the State. Loss in 1943 was estimated as 3.9%. Celery mosaic (virus 1- southern type) was general in celery growing districts in the State. A moderate amount was present in Jefferson County. Loss in 1943 amounted to a trace.

ASPARAGUS OFFICINALIS, ASPARAGUS. Puccinia asparagi, rust, was observed in Larimer County on wild asparagus. All commercial fields are planted to the Martha Washington resistant variety.

BETA VULGARIS, GARDEN BEET. Cercospora beticola, leaf spot, was general over the entire State; loss was a trace. Black heart due to phosphate deficiency, was general in Otero County, causing loss amounting to 1%.

BRASSICA OLERACEA var. CAPITATA, CABBAGE. Erwinia carotovora, soft rot, was general over the entire State, causing loss of a trace. Fusarium oxysporum f. conglutinans, yellows, was observed in Adams, Arapahoe, Costilla, Conejos, Denver, Jefferson, and Weld Counties. In past years it has been most severe in Adams, Arapahoe, Denver, and Jefferson Counties. Resistant varieties are now grown exclusively. Losses in affected fields in 1943 ranged from none to a trace.

CAPSICUM FRUTESCENS, PEPPER. Alternaria sp., fruit rot, was general in occurrence over the entire State, but loss was a trace. Phytophthora capsici, blight, was observed in Adams, Arapahoe, Denver, Fremont, Jefferson, Otero, and Pueblo Counties, causing loss of 2%. Mosaic (virus) was generally distributed and resulted in a loss of 0.5%. A ringspot type of virus was general and caused a trace of loss over the eastern slope of Colorado.

CUCUMIS MELO, CANTALOUP. Erwinia tracheiphila, wilt, caused a trace of loss in Bent, Crowley, Otero, and Pueblo Counties. A trace of Erysiphe cichoracearum, powdery mildew, was observed in McElmo Canyon, Montezuma County. Alternaria cucumerina (Macrosporium cucumerinum), leaf blight, occurred in Bent, Crowley, Otero, and Pueblo Counties and caused loss of 5%. Phytophthora capsici, fruit rot, caused 1% loss in Bent, Crowley, Otero, and Pueblo Counties.

CUCUMIS MELO, HONEY-DEW. Colletotrichum lagenarium, anthracnose, occurred in Pueblo County. Loss amounted to 1%. Phytophthora capsici, fruit rot, in Crowley and Pueblo Counties, caused 2% loss.

CUCUMIS SATIVUS, CUCUMBER. Erwinia tracheiphila, wilt, was general over the entire State. Mosaic (virus) was observed in Larimer, Mesa, and Weld Counties. Each disease caused a trace of loss.

CUCURBITA MAXIMA, SQUASH. Fusarium sp., root rot and wilt, caused a trace of loss in Arapahoe, Jefferson, and Larimer Counties. Attack by mosaic (virus) in Arapahoe and Jefferson Counties resulted in 6% loss.

DAUCUS CAROTA, CARROT. Erwinia carotovora, soft rot, was general over the entire State but loss was a trace. Aster yellows (virus) caused 3% loss in Jefferson County.

LACTUCA SATIVA, LETTUCE. Pythium debaryanum, damping-off, caused 2% loss in seedbeds in Fremont and Rio Grande Counties. Mosaic (virus) was noted in Fremont County where it caused loss amounting to 10%. Tip-burn (physiogenic) caused 3% loss in Rio Grande County.

LYCOPERSICON ESCULENTUM, TOMATO. Alternaria solani (early blight), Fusarium oxysporum f. lycopersici (Fusarium wilt), Corynebacterium michiganese (bacterial canker) which occurred mostly in Victory gardens, and Verticillium albo-atrum (wilt), were of general occurrence throughout the State and each caused a trace of loss. Cladosporium fulvum (leaf mold) caused a trace of loss in Denver greenhouses. Phytophthora capsici (fruit rot) caused traces of loss in Adams, Arapahoe, Jefferson, Larimer, Otero, Pueblo, and Weld Counties. None was found on the western slope of Colorad

Of the virus diseases, aucuba mosaic was general in occurrence and cause 0.5% loss. Curly-top occurred on the western slope but caused no loss. A ringspot type of virus disease was general throughout the eastern slope but was mostly confined to Victory gardens and loss was 0.2%. Spotted wil was observed to the extent of a trace in Denver, Jefferson, and Mesa Counties.

Blossom-end rot and sunscald (physiogenic) were both general over the entire State causing losses of 0.1% and 2%, respectively. A high percentage of the fruit was sunscalded on the Cardinal variety in Mesa County.

PHASEOLUS VULGARIS, BEAN. Fusarium solani f. phaseoli (F. martii var. phaseoli), dry root rot, was observed in Delta, Elbert, El Paso, Lincoln, Mesa and Pueblo Counties. It was most severe in Mesa County. Loss in 194 was estimated at 2%. Pseudomonas medicaginis var. phaseolicola, bacterial halo blight, and Xanthomonas phaseoli, common bacterial blight, were both general in distribution and caused losses amounting to a trace. Uromyces phaseoli var. typica, rust, was general but most severe in Weld County. Loss was a trace.

Mosaic (yellow and green types, virus) was general over the entire State and caused 1% loss. Red node virus disease was also general but caused a trace of loss.

A nonparasitic trouble was noted in Mesa County where it caused 2% loss.

PISUM SATIVUM, PEA. Erysiphe polygoni (powdery mildew) was observed causing a trace of loss in the vicinity of Del Norte in Rio Grande County. Xanthomonas (Phytomonas) pisi (bacterial blight) occurred in Conejos Count where it caused 1% loss.

Asochyta pinodella, (root rot) occurred in Del Norte, Rio Grande County where it caused 1% loss. Pythium sp. (root rot) was general over the entire State and caused a trace of loss. Root rots due to Fusarium solani f pisi (F. martii var. pisi) and to Rhizoctonia solani were also generally distributed; these diseases, however, were more prevalent in the San Luis Valley. Fusarium caused 2% loss, Rhizoctonia a trace.

SOLANUM MELONGENA, EGGPLANT. Verticillium albo-atrum, wilt, was observe in the northern part of Colorado causing a trace of loss.

SOLANUM TUBEROSUM, POTATO. Actinomyces scabies (scab) occurred generall however, it was most prevalent in Garfield and Weld Counties. Loss was 2%

Fusarium solani f. eumartii (wilt) was general but most prevalent in the northern and northeastern sections; loss was 1%.

Fusarium javanicum var. radicicola (jelly end rot) was generally distributed but most prevalent on the western slope; loss was a trace.

Other diseases of general occurrence include Alternaria solani (early blight) with 0.5% loss; Corynebacterium sepedonicum (ringrot) 2%; Erwinia phytophthora (E. atroseptica) (blackleg) 0.5%; Fusarium oxysporum (wilt) 0.3%; Rhizoctonia solani, 0.5%; and seed piece decay due to Fusarium sp. and Erwinia carotovora which caused 3% loss in stands.

Fusarium solani (wilt) was general in fields in the San Luis Valley where loss was 0.2%. Fusarium trichothecioides (powdery dry rot) occurred in the San Luis Valley and in Weld County and caused a trace of loss.

Phytophthora infestans (late blight) was general in Morgan and Weld Counties. Loss in the two counties, as far as evident to date, amounted to 2%.

Except for calico which was scattered in distribution and caused no loss, virus diseases were general in occurrence. Losses estimated were 0.1% from giant hill, 0.8% from haywire, 1% from leaf roll, 0.4% from mild and crinkle mosaic, 0.2% from rugose mosaic and 0.8% from spindle tuber.

Growth crackings and sun scald occurred generally but were most prevalent in the San Luis Valley. Loss amounted to 2% from growth cracks and 1% from sun scald. Hollow heart also was general; loss was a trace.

TRAGOPOGON PORRIFOLIUS, SALSIFY. Albugo tragopogoni, white rust, was noted in Larimer County.

CEREALS, GRASSES, AND FORAGE CROPS

AVENA SATIVA, OATS. Puccinia coronota, crown rust, was scattered in distribution and caused no loss.

Puccinia graminis var. avenae, stem rust, Ustilago avenae, loose smut, and U. kolleri (U. levis), covered smut, were general over the State and each caused a trace of loss.

BROMUS spp., BROME GRASS. Claviceps purpurea, ergot, was noted on Bromus inermis (smooth brome grass) in Larimer County. Ustilago bromivora, smut, occurred on B. tectorum (downy brome grass) in the foothills of Larimer County.

HORDEUM VULGARE, BARLEY. Claviceps purpurea (ergot) occurred to the extent of a trace in Larimer County. Other diseases observed were generally distributed in the State. Erysiphe graminis (powdery mildew), Helminthosporium gramineum (stripe), Puccinia graminis var. tritici (stem rust), and Ustilago jensenii (U. hordei) (covered smut) caused traces of loss.

Ustilago nuda (loose smut) caused 1% loss. No loss was caused by Puccinia anomala (P. dispersa) (leaf rust).

MEDICAGO SATIVA, ALFALFA. Corynebacterium insidiosum (bacterial wilt) and Pseudopeziza medicaginis (leaf spot) both were general in occurrence and each caused loss estimated at 1%.

Peronospora trifoliorum (downy mildew) was noted causing a trace of damage in Boulder, Laramie, and Weld Counties. Mosaic (virus) was general over the entire State but loss was a trace.

SECALE CEREALE, RYE. Claviceps purpurea, ergot, caused a trace of loss in Larimer County. Puccinia graminis var. secalis, stem rust, occurred on rye in Larimer and Weld Counties but caused no loss.

SORGHUM VULGARE, SORGHUM. Fusarium sp.-Pythium sp., seedling blight complex was general over the entire State and resulted in 1% reduction in stand.

Sphacelothecia sorghi, covered kernel smut, was also general; loss was 2%.

TRITICUM AESATIVUM, WHEAT. Erysiphe graminis var. tritici (powdery mildew was general and caused a trace of loss for both winter and spring wheat.

Helminthosporium sativum (dryland foot-rot) occurred in northeastern and eastern Colorado; loss was 1%.

Puccinia graminis var. tritici (stem rust) was general over the entire State on both winter and spring wheat. Loss to winter wheat ranged from none to a trace; on spring wheat from a trace to 1%. Heaviest losses in spring wheat occurred in Archuleta, La Plata, and Montezuma Counties.

P. rubigo-vera var. tritici (P. triticina) (leaf rust) was general and caused losses ranging from none to a trace on both winter and spring wheat

Septoria tritici (speckled leaf blotch) caused a trace of loss in northeastern Colorado.

Tilletia foetida (T. laevis) (bunt) was general and caused a trace of loss while T. caries (T. tritici) was observed in Routt County, where loss ranged from none to a trace.

Ustilago tritici (loose smut) was general; loss was not more than a trac

ZEA MAYS, CORN. Fusarium moniliforme (ear and seed rot), Pythium sp. and Fusarium sp. causing seedling blights, were general over the entire State and caused losses estimated at a trace to 1%.

Ustilago maydis (U. zeae) (smut) was also general; loss was 1%.

Puccinia sorghi (rust) was observed in Conejos County.

Sclerotium bataticola (charcoal rot) had been found in Baca County in 1942 but none was found in 1943.

FRUIT AND NUT CROPS

AMYGDALUS COMMUNIS, ALMOND. Peach mosaic (virus) was found only in Mesa County when artificially inoculated into almond trees.

AMYGDALUS PERSICA, PEACH. Coryneum carpophilum (C. beijerinckii, Helminthosporium carpophilum), blight, was observed in Delta and Mesa Counties and Paradox Valley in Montrose County; loss was a trace. Poria sp., white heart rot, occurred in the Redlands district of Mesa County. Rhizopus nigricans, black mold rot, was found only on dead ripe fruit in orchards in Delta and Mesa Counties; loss ranged from none to a trace. Sphaerotheca pannosa, powdery mildew, and Agrobacterium tumefaciens, crowngall, caused losses amounting to a trace in Delta and Mesa Counties. Taphrina deformans leaf curl, was found in Mesa County, on nursery stock shipped in from the northwestern part of the United States.

The virus diseases golden net and X-disease were observed in Mesa County, causing loss ranging from none to a trace. Peach mosaic occurred in Mesa and Montezuma Counties; loss was 0.5%.

Chlorosis (nonparasitic) was observed in Delta, Mesa, Montezuma, and Montrose Counties. Of all the peach trees in Colorado 2.5% show symptoms of chlorosis. Usually No. 2 fruit is produced on affected trees, which amounts to 75,000 bushels. Gummosis (physiogenic) also occurred in Delta, Mesa, Montezuma, and Montrose Counties; loss was a trace.

AMYGDALUS PERSICA var. NECTARINA, NECTARINE. Peach mosaic (virus) was noted in Mesa County, causing loss of a trace; and chlorosis (physiogenic) in Delta and Mesa Counties.

FRAGARIA, STRAWBERRY. Black root due to a complex of organisms was general over the entire State, attack resulting in 1% loss.

Mycosphaerella fragariae, leaf spot, caused a trace of loss in Jefferson and Larimer Counties.

Phytophthora fragariae, red stele, was generally distributed, causing loss estimated at 2.5%.

Xanthosis (virus) was observed in trace amounts in Larimer County.

MALUS SYLVESTRIS, APPLE. Erwinia amylovora, fireblight, occurred generally but was more prevalent in the North Fork district in Delta County and the Canon City area in Fremont County. Loss was 2.5%. Podosphaera sp., powdery mildew, was observed in trace amounts in Fremont County. Venturia inaequalis, scab, occurred in Morgan County but no loss resulted.

PRUNUS sp., CHERRY. Agrobacterium (Phytomonas) tumefaciens (crowngall) occurred generally wherever cherries were grown, but loss was a trace. Podosphaera oxyacanthae (powdery mildew), was noted in trace amounts in Jefferson and Larimer Counties. Schizophyllum commune, sap rot, caused a trace of damage in Larimer County. Mosaic (virus) was general in Mesa County on the Royal Duke variety. Loss was a trace. Rasp-leaf (virus) was prevalent in Delta County, and occurred to a slight extent in Mesa County. Loss was 0.5%.

PRUNUS AMERICANA, AMERICAN WILD PLUM. Dibotryon morbosum (Plowrightia morbosa), black knot, and Taphrina pruni, plum pockets, were observed in the foothills in Larimer County.

PRUNUS ARMENIACA, APRICOT. Coryneum carpophilum (C. beijerinckii) (blight) caused a trace of loss in Delta and Mesa Counties.

Ringspot (virus) caused 0.5% loss in Mesa County. Chlorosis (nonparasitic) occurred in Delta, Mesa, Montezuma, and Montrose Counties, causing loss of a trace.

PYRUS COMMUNIS, PEAR. Erwinia amylovora (fireblight) and chlorosis (nonparasitic) were observed causing traces of loss in Delta and Mesa Counties. Phosphorus deficiency was noted in Mesa County; loss was a trace.

RUBUS sp., RASPBERRY. Mycosphaerella rubina, spur blight, mosaic (virus) and winter injury were scattered in occurrence over the State. Losses were a trace from spur blight and 1% each from mosaic and winter injury.

SPECIAL CROPS

BETA VULGARIS, SUGAR BEET. Cercospora beticola, leaf spot, was general over the entire State. Heavy infections were noted in some fields in Boulder, Larimer, Otero, Pueblo, and Weld Counties. Loss was 2.5%.

Heterodera schachtii, the sugar beet nematode, occurred in Larimer County, causing a trace of loss.

Pythium butleri, root rot, was general over the eastern slope of Colorado. Loss was a trace. Pythium sp., Rhizoctonia solani, Phoma betae, and Fusarium sp. causing damping-off and black root, were general over the entire State; causing loss amounting to 1%. Rhizoctonia solani, causing root rot, was also generally distributed over the entire State. In some fields a high percentage of the plants were infected. Loss was 1%.

Verticillium albo-atrum, wilt, was observed in Weld County; loss was a trace.

The virus diseases caused traces of loss. Curly top was observed in Delta, Mesa, and Montrose Counties; mosaic was general over the entire State; savoy was noted in Larimer County; and vein mosaic in Larimer and Weld Counties.

Black heart due to phosphate deficiency was general over the eastern slope of Colorado and caused a trace of loss.

MISCELLANEOUS CROPS

ACER spp., Pleurotus ulmarius, white sap rot, was noted on Acer negundo, box elder, in Larimer County; and Cytospora chrysosperma, canker, on Acer sp. in El Paso County.

ALTHAEA ROSEA. Puccinia malvacearum (rust) was general over the entire State.

ANTIRRHINUM MAJUS. Puccinia antirrhini, rust, was general over the entire State.

BEGONIA sp. Botrytis sp., blight, and Xanthomonas (Phytomonas) begoniae, leaf spot, caused a trace of loss in Denver and Larimer Counties.

BERBERIS VULGARIS. In La Plata County the aecial stage of Puccinia graminis, stem rust was prevalent on the barberry. Adjacent wheat fields were heavily infected with stem rust.

CALLISTEPHUS CHINENSIS. Fusarium oxysporum f. callistephi (F. conglutinans var. callistephi), wilt, was general and caused a trace of loss in Denver and Jefferson Counties. Aster yellows (virus) was general over the entire State; loss was a trace.

CHRYSANTHEMUM sp. Erysiphe cichoracearum, powdery mildew, and mosaic (virus) were observed in Jefferson County; loss from the former was a trace, from mosaic 0.5%.

DAHLIA sp. Mosaic (virus) was observed in trace amounts in Jefferson County.

DELPHINIUM sp. Erysiphe polygoni, powdery mildew, was noted in Larimer County. No loss resulted.

DIANTHUS CARYOPHYLLUS. Alternaria dianthi (branch rot and leaf spot), Fusarium oxysporum f. dianthi, (wilt), and Uromyces caryophyllinus (rust) were noted in Denver greenhouses, where each caused a trace of loss.

GARDENIA sp. Fusarium sp. caused root rot in Denver greenhouses, resulting in loss of a trace.

GLADIOLUS sp. Fusarium sp. (root rot), and Pseudomonas (Phytomonas) marginata, scab, were general over the entire State. Losses were a trace and 1.5%, respectively.

HYDRANGEA sp. Erysiphe polygoni, powdery mildew, was noted in Larimer County.

IRIS sp. Didymellina iridis, leaf spot, occurred generally over the entire State and caused a trace of loss.

Puccinia iridis, rust, was observed on wild iris in Larimer County.

LATHYRUS ODORATUS. Erysiphe polygoni (powdery mildew), and Fusarium solani f. pisi (F. martii var. pisi) (root rot) were general over the entire State. Each caused a trace of loss.

MENTHA sp. *Puccinia menthae*, rust, was observed in Larimer County.
NARCISSUS sp. *Fusarium* sp., bulb rot, was observed in Denver greenhouses where it caused a trace of loss.
PAEONIA sp. *Botrytis paeoniae*, blight, was general in distribution and caused a trace of damage.
PRUNUS VIRGINIANA. *Podosphaera oxyacanthae* (powdery mildew) was observed in Jefferson and Larimer Counties.
ROSA sp. *Diplocarpon rosae* (black spot) was noted in Denver greenhouses, *Phragmidium* sp. (rust) in Larimer County, and *Agrobacterium* (Phytomonas) *tumefaciens* (crowngall) and *Sphaerotheca pannosa* (powdery mildew) were general over the entire State. Loss from each disease was a trace.
TULIPA sp. *Botrytis tulipae*, Botrytis blight, was noted in Larimer County.
ZINNIA ELEGANS. *Erysiphe cichoracearum*, powdery mildew, was general over the entire State, and caused a trace of damage.

PLANT DISEASES OBSERVED IN ARIZONA AND NEW MEXICO, 1943

Wm. G. Hoyman

VEGETABLE CROPS

ABELMOSCHUS ESCULENTUS, OKRA. *Fusarium oxysporum* f. *vasinfectum*, wilt, occurred in Arizona. *Heterodera marioni*, rootknot, was noted in New Mexico.
ALLIUM CEPA, ONION. *Phoma terrestris*, pink root, was observed in Arizona.
APIUM GRAVEOLENS, CELERY. *Septoria apii*, late blight, was noted in New Mexico.
ASPARAGUS OFFICINALIS, ASPARAGUS. *Cercospora asparagi* occurred in New Mexico.
BETA VULGARIS, GARDEN BEET, and var. CICLA, SWISS CHARD. *Cercospora beticola* occurred on beets in both States. *Fusarium* sp. was noted on beets in Arizona, and curly top (virus), on beets and Swiss chard in the same State.
BRASSICA spp. *Erysiphe polygoni*, powdery mildew, was observed on rutabaga in New Mexico, on turnip in both States, and on mustard (*B. juncea*) in Arizona. *Phoma lingam*, blackleg, occurred on cabbage and cauliflower in New Mexico. *Sclerotinia sclerotiorum*, watery soft rot, was observed on cabbage and Chinese cabbage in Arizona. *Xanthomonas campestris*, black rot, was noted on cabbage in both States. *Heterodera marioni*, rootknot, was noted on rutabaga and Chinese cabbage in Arizona.
CAPSICUM FRUTESCENS, PEPPER. Wilt (*Fusarium annuum*), curly top (virus), and sun scald (nonparasitic), affected both bell and chili peppers in both States. On chili peppers blossom-end rot (physiogenic) was observed in both States, and mosaic (virus) in Arizona. Paprika peppers in Arizona were affected by *Fusarium* wilt, curly top, and mosaic.
CICHORIUM ENDIVIA, ENDIVE. *Sclerotinia sclerotiorum*, watery soft rot, was observed in Arizona.

CITRULLUS VULGARIS, WATERMELON. Colletotrichum lagenarium, anthracnose, occurred in both States. Alternaria cucumerina, leaf blight, and Heterodera marioni, rootknot, were observed in Arizona.

CUCUMIS MELO, CANTALOUP. Alternaria cucumerina, leaf blight, and Erysiphe cichoracearum, powdery mildew, were observed in Arizona.

CUCUMIS SATIVUS, CUCUMBER. Erysiphe cichoracearum occurred in New Mexico.

CUCURBITA PEPO, PUMPKIN. Erysiphe cichoracearum and mosaic (virus) were observed in New Mexico.

CUCURBITA PEPO, SUMMER SQUASH. Erysiphe cichoracearum, Fusarium oxysporum f. niveum (wilt), and the virus diseases curly top and mosaic were noted in Arizona.

DAUCUS CAROTA, CARROT. Alternaria carotae (leaf blight), and Cuscuta sp. (dodder) were observed in New Mexico, and Heterodera marioni (rootknot) in Arizona.

IPOMOEA BATATAS, SWEETPOTATO. Monilochaetes infuscans (scurf) and Rhizopus nigricans (soft rot) occurred in both States; Phymatotrichum omnivorum (root rot) and Sclerotium rolfsii (southern blight) in Arizona; and Endoconidiophora (Ceratostomella) fimbriata in New Mexico.

LACTUCA SATIVA, LETTUCE. Drop or watery soft rot (Sclerotinia sclerotiorum), the virus diseases mosaic and big vein, and tipburn (physiogenic) were observed in Arizona.

LYCOPERSICON ESCULENTUM, TOMATO. Alternaria solani (early blight), Fusarium oxysporum f. lycopersici (Fusarium wilt), Heterodera marioni (rootknot), curly top (virus), blossom-end rot (physiogenic), phosphorus deficiency, and psyllid yellows induced by the tomato psyllid, were all observed in both States. Spotted wilt (virus) occurred in Arizona.

PHASEOLUS LUNATUS, LIMA BEAN. Witches' broom (virus) was found in Arizona.

PHASEOLUS VULGARIS, BEAN. Powdery mildew (Erysiphe polygoni), dry root rot (Fusarium solani f. phaseoli) (F. martii var. phaseoli), rootknot (Heterodera marioni), rust (Uromyces phaseoli var. typica), and the virus diseases mosaic and witches' broom were observed in Arizona. Bacterial blight (Xanthomonas phaseoli) occurred in both States.

PHASEOLUS VULGARIS, MEXICAN PINK BEAN. Xanthomonas phaseoli (bacterial blight), curly top (virus), and mosaic (virus), occurred in Arizona.

PHASEOLUS VULGARIS, PINTO BEAN. Rust and bacterial blight were observed on pinto bean in both States. Rootknot and dry root rot were noted in Arizona; powdery mildew and curly top in New Mexico.

PISUM SATIVUM, PEA. Root rot (Fusarium solani f. pisi) was noted in New Mexico; rootknot (Heterodera marioni) in Arizona.

SOLANUM MELONGENA, EGGPLANT. Fusarium sp. was observed in Arizona. Verticillium wilt (V. albo-atrum) occurred in New Mexico.

SOLANUM TUBEROSUM, POTATO. Early blight (Alternaria solani), bacterial ringrot (Corynebacterium sepedonicum), and psyllid yellows occurred in both States. Scab (Actinomyces scabies), wilt (Fusarium oxysporum), Rhizoctonia (R. solani), and second growth due to weather conditions were observed in Arizona; and blackleg (Erwinia phytophthora) in New Mexico.

SPINACIA OLERACEA, SPINACH. Root rot (Fusarium sp.) occurred in Arizona.

CEREALS AND FORAGE CROPS

AVENA SATIVA, OAT. Loose smut (Ustilago avenae) occurred in Arizona.

CYAMOPSIS TETRAGONOLOBUS, GUAR. Fusarium sp. was noted in Arizona.

MEDICAGO SATIVA, ALFALFA. Corynebacterium insidiosum (bacterial wilt), Cuscuta sp. (dodder), Peronospora trifoliorum (downy mildew), Phymatotrichum omnivorum (root rot), Pseudopeziza medicaginis (leaf spot), rust (Uromyces striatus var. medicaginis) and girdle due to insect activity were noted in both States. Colletotrichum trifolii (anthracnose), Fusarium oxysporum f. medicaginis (wilt), Rhizoctonia solani (stem canker) and the virus diseases mosaic and witches' broom were observed in Arizona. Ascochyta imperfecta and white spot (nonparasitic) occurred in New Mexico.

SECALE CEREALE, RYE. Bacterial blight (Xanthomonas translucens f. sp. secalis) was observed in Arizona.

SOJA MAX, SOYBEAN. Bacterial pustule (Xanthomonas phaseoli var. sojense) occurred in Arizona.

SORGHUM VULGARE, SORGHUM. Xanthomonas holcicola was observed on sorghum in New Mexico; Pseudomonas syringae on sudan grass (S. vulgare var. sudanense) in Arizona.

ZEA MAYS, CORN. Ustilago maydis (smut) was noted on field corn in both States and on sweet corn in Arizona.

FRUIT AND NUT CROPS

AMYGDALUS PERSICA, PEACH. Mosaic (virus), iron and nitrogen deficiency, and immature fruits produced by the Hale variety, were observed in both States. Agrobacterium tumefaciens (crowngall) and wart (virus) occurred in Arizona; Phymatotrichum omnivorum (root rot) in New Mexico.

CARYA ILLINOENSIS, PECAN. Phymatotrichum omnivorum (root rot) occurred in Arizona, and rosette (nonparasitic) was observed in both States.

CITRUS PARADISI, GRAPEFRUIT. Psorosis A (virus), decline disease (undetermined), and iron and zinc deficiency were observed in Arizona.

CITRUS SINENSIS, ORANGE. Fruit rot (Alternaria citri), psorosis A, decline, and zinc deficiency were observed in Arizona.

FRAGARIA, STRAWBERRY. Leaf spot (Mycosphaerella fragariae), fruit rots (Phytophthora cactorum and Rhizopus nigricans), and iron deficiency were noted on strawberry in Arizona.

MALUS SYLVESTRIS, APPLE. Phymatotrichum omnivorum was observed attacking apple in Arizona. Erwinia amylovora (fireblight) and Podosphaera leucotricha (powdery mildew) occurred in New Mexico. Iron deficiency was noted in both States.

PRUNUS sp., PLUM. Crowngall (Agrobacterium tumefaciens), rootknot (Heterodera marioni), and root rot (Phymatotrichum omnivorum) were observed in Arizona.

PRUNUS ARMENIACA, APRICOT. Apricots in Arizona were affected by iron deficiency.

PRUNUS AVIUM, SWEET CHERRY. Crowngall (Agrobacterium tumefaciens) was observed in New Mexico.

PYRUS COMMUNIS, PEAR. Fireblight (Erwinia amylovora) occurred on pear trees in both States.

RIBES GROSSULARIA, GOOSEBERRY. Crowngall (Agrobacterium tumefaciens) was noted in Arizona.

RUBUS sp., BOYSENBERRY. Mycosphaerella rubi was observed in Arizona.

VITIS sp., GRAPE. Iron deficiency was noted in New Mexico.

SPECIAL CROPS

ARACHIS HYPOGAEA, PEANUT. Phymatotrichum omnivorum (root rot) was observed in Arizona; Sclerotium rolfsii (southern blight) in New Mexico.

BETA VULGARIS, SUGAR BEET. Leaf spot (Cercospora beticola) and curly top (virus) affected sugar beets in both States. Mosaic (virus) and nitrogen deficiency were observed in Arizona.

GOSSYPIUM, COTTON. Cotton in both States was affected by Alternaria sp. (leaf spot), Phymatotrichum omnivorum (root rot), Puccinia stakmanii (P. boutelouae) (rust), Verticillium albo-atrum (wilt), Xanthomonas malvacearum (angular leaf spot), and nitrogen deficiency. Fusarium roseum occurred on the bolls in Arizona.

PARTHENIUM ARGENTATUM, GUAYULE. Fusarium sp. was observed attacking this plant in Arizona.

SALVIA OFFICINALIS, SAGE. Heterodera marioni (rootknot) occurred in Arizona.

OBSERVATIONS ON PLANT DISEASES IN UTAH DURING 1943

Seth Barton Locke

Collaborators

Utah Agricultural Experiment Station
- Dr. B. L. Richards, Plant Pathologist
- Dr. H. L. Blood, Plant Pathologist (Coop. U.S.D.A.)
- Mr. A. F. Bracken, Associate Agronomist
- Mr. Roy Christiansen, Research Assistant in Plant Pathology
- Mr. M. Shapovalov, Senior Plant Pathologist (Coop. U.S.D.A.)

Utah State Agricultural College Extension Service
- Mr. Clarence D. Ashton, Assistant County Agent, Utah County
- Mr. A. L. Christiansen, County Agent, Weber County

Utah State Agricultural Commission
- Mr. Earl Hutchings, Chief of Inspection Service
- Mr. H. V. Swenson, Inspector, Utah County
- Mr. L. Wynn, District Inspector, Cache and Boxelder Counties.

Major Pathological Problems

Bacterial Wilt of Alfalfa is the limiting factor determining the profitable life of alfalfa stands in the State. It has become the practice to plow under all stands older than 3 years. Variety tests and a breeding

program aimed at making available strains of alfalfa well adapted to the region and resistant to bacterial wilt have been conducted for a number of years at the Utah Agricultural Experiment Station. Progress has been made in this direction.

Virus Diseases of Potatoes. Growers of the State have been unable to obtain virus-free potato seed in sufficient quantities to fill their needs. The Station has inaugurated a project this year providing for the cooperation of the Department of Botany and Plant Pathology with other departments and agencies to provide for the establishment of virus-free stocks by tuber indexing, tuber-unit rogueing, and supervision of the increasing of the foundation stock in isolated fields.

Potato Wilt has been a serious and recurrent source of loss to potato growers in the State. No research is being conducted at present on this problem at the Utah Station. A great amount of work done at other stations has clarified certain phases of the problem but progress toward development of satisfactory control measures has been discouraging. Further basic studies are needed, especially in the direction of determining the pathogens involved in several areas of the country, the effect of soil amendments and cultural practices, and possibly a breeding program to develop resistant varieties. The regional nature of the problem argues for a coordinated series of studies at the various stations concerned and for Federal support.

Tomato Diseases. Three diseases have constituted the major pathological threat to commercial tomato production in Utah. Bacterial Canker has been reduced by the development and application of a satisfactory control program until at present it causes serious losses only in isolated plantings where the necessary precautions are not observed. Curly-top and Verticillium wilt individually and together continue to exact serious losses every year. The Utah Station, in cooperation with the Bureau of Plant Industry, has supported an extensive research program aimed at development of resistant varieties to substitute for those now being grown. With respect to Verticillium wilt, progress has been such that the desired strain should be perfected in the near future. Development of strains resistant to Curly-top has been slower but results encourage the belief that the attempt will be successful eventually.

Virus and Similar Diseases of Stone Fruits. A total of 9 virus and bud-propagated non-virus diseases are now known to be present in Utah. As a group they constitute a threat to the industry which, if ignored, might result in its serious crippling in the very near future. Studies at the Utah Station and in several Western States indicate that immediate action should be taken to halt the spread of these diseases. What is particularly needed, in the opinion of Dr. Richards, is the establishment of a source of disease-free bud wood, scions and rootstocks. It seems evident that the States involved must act either individually or in cooperation, to secure this end at the very earliest moment possible.

Western "X" Disease of Peaches has become so well established in the northern counties of the State that eradication would involve the removal of approximately 30% of the bearing trees. It is far from certain that this drastic action would eliminate the disease. In Utah County, on the other hand, only 1.4% of the trees are infected according to data obtained in connection with the survey conducted there this season. Their removal could be undertaken with relatively little sacrifice considering the benefit that would be obtained should this result in the elimination of the disease from the County.

Root Rots of Sugar Beets of widely different nature have been a continuous source of loss over a number of years. Excepting for Dry-rot Canker (Pellicularia filamentosa) (Corticium vagum), the causes are unknown. This problem needs attention in order to clarify the nature of the causal organisms involved and to determine the effect of environmental factors and cultural practices on the development of the disease.

Powdery Mildew of Cantaloupes has been serious in the Green River area in Southeastern Utah for a number of years. It has occurred in a number of instances in the Northern Counties and might develop to serious proportions there in the future. No studies on this disease are being conducted in connection with this problem at present.

Diseases of Vegetable Seed Crops. Considerable expansion in the acreage devoted to production of vegetable seeds is expected in the near future. In cooperation with the Bureau of Plant Industry, the Station is conducting studies on the growing of these crops. The project is so young that the pathological problems which might develop have not yet clearly appeared.

VEGETABLE CROPS

Diseases of truck crops observed in Utah in 1943

Crop	Sample Fields	Sample Acres	Disease	% of plants affected	Estimated loss (%)
Onion	9	29.75	Fusarium bulb rot	0.17	0.17
Celery	2	2.5	No disease found		
Asparagus	1	0.5	No disease found		
Beet	1	1	Leaf spot	100.	Insignificant
Cabbage	12	17.25	Mosaic	.01	"
Turnip	2	0.75	Powdery mildew	66.7	"
Pepper	1	0.1	No disease found		
Watermelon	2	0.55	No disease found		
Muskmelon	6	9.6	Fusarium wilt	0.15	0.1
Cucumber	3	1.25	Mosaic	0.8	Insignificant
Carrot	9	11.35	Late blight	8.5	"
Snap Beans	15	23.25	Mosaic	15.9	3.7
Snap Beans	15	23.25	Halo blight	34.4	11.5
Snap Beans	15	23.25	Foot rot	6.5	4.5
Dry Beans	3	16.	Mosaic	63.87	15.97
Dry Beans	3	16.	Halo blight	13.75	4.5
Dry Beans	3	16.	Foot rot	0.75	0.75
Lima Beans	3	6.	No disease found		
Egg Plant	1	0.1	No disease found		
Sweet Corn	4	2.	Common Smut	5.93	5.93

ALLIUM CEPA, ONION (9 plantings). Fusarium spp. (Fusarium Bulb Rot). In a single field near American Fork, 5% of the mature bulbs showed the root system entirely rotted away and the rot extending into the bases of the scales.

APIUM GRAVEOLENS, CELERY (3 plantings). No disease was found.

ASPARAGUS OFFICINALIS, ASPARAGUS (1 planting). One planting in Davis County was free from disease. Volunteer plants in the fence rows in

Washington County were also free from disease.

BRASSICA OLERACEA var. CAPITATA, CABBAGE (12 plantings). Virus (Mosaic) Cabbage plantings were entirely free from disease excepting for one in Utah County where a trace of mosaic was observed.

BRASSICA RAPA, TURNIP (2 plantings). Erysiphe pologoni (Powdery Mildew) Two plantings in Boxelder and Cache Counties were affected with powdery mildew. The foliage was 50% and 100% covered.

CAPSICUM FRUTESCENS, PEPPER (1 planting). This planting was free from disease.

CITRULLUS VULGARIS, WATERMELON (2 plantings). These plantings were free from disease.

CUCUMIS MELO, MUSKMELON (6 plantings). Erysiphe cichoracearum (Powdery Mildew), was not observed in 1943. However, it has been very destructive in the Green River district in the past few years, according to Dr. Richards, and has been found in Davis, Weber and Boxelder Counties more recently.

Fusarium oxysporum f. melonis (F. bulbigenum var. niveum f. 2.) (Fusarium wilt) was observed in two fields in Weber County affecting 0.5% and 1% of the vines. Four other fields in Boxelder, Davis, and Washington Counties were free from disease.

CUCUMIS SATIVUS, CUCUMBER (3 plantings). Virus (Mosaic). One planting of cucumber in Weber County showed 4% of the vines affected with mosaic. Two other plantings in Boxelder and Davis Counties were free from disease.

DAUCUS CAROTA, CARROT (9 plantings). Cercospora carotae (C. apii var. carotae) (Late blight). A total of 9 carrot plantings were visited in six counties. Late blight was found in amounts varying from a trace in Weber County to 30% of the plants heavily spotted and 1% nearly defoliated in one field in Utah County. No disease was found in the single carrot planting visited in Sevier County.

LYCOPERSICON ESCULENTUM, TOMATO. Dr. Blood and Mr. Roy Christiansen have made a survey of tomato diseases in Utah over a period of eight years. Their observations will be published in detail in the Plant Disease Reporter at an early date. Only a few fields of tomatoes were visited in the course of the general survey because this special survey was being made.

Erwinia carotovora (Soft Rot). Dr. Blood reports that bacterial soft rot caused heavy losses in about 25 acres in Davis County and slight loss in a great many, probably 10%, of the fields in the State.

Corynebacterium michiganense (Bacterial Canker) was one of the most destructive of tomato diseases a few years ago, and although a satisfactory control program for it is available, it continues to cause a certain amount of loss. On a trip into Weber County with Mr. Christiansen, several fields were seen where a high percentage of the plants were affected. In one field approximately 45% of the plants were severely affected. Dr. Blood states that a number of fields in Cache County were also badly damaged by this disease.

Non-parasitic (Blossom-end Rot). Dr. Blood states that this is frequently the source of considerable loss where irrigation has not been handled properly.

Verticillium albo-atrum (Verticillium Wilt) is possibly the most damaging of the tomato diseases in the State. The disease is widely distributed in the soils of the State and at present no control measures are available.

Phytophthora parasitica (Buckeye Rot). Dr. Blood reports observing this disease occasionally.

Virus (Curly Top). Curly top is a major hazard for commercial tomato production in Utah. In the Virgin River Valley in Southern Utah it is the limiting factor preventing tomato growing on a commercial scale. In Dr. Blood's tomato breeding plots near Hurricane, Washington County, commercial varieties planted as controls were 100% affected. This season, however, it was much less prevalent than usual in the Northern Counties.

Virus (Mosaic). This disease was observed in six plantings, ranging from a trace to 50% of the plants in one field in Cache County. In another field a single plant was found exhibiting the symptoms of the yellow form of mosaic.

PHASEOLUS VULGARIS, COMMON BEAN (18 plantings). Xanthomonas phaseoli (Bacterial Blight). One field in Boxelder County was found in which 1% of the plants were spotted with bacterial blight on leaves and pods.

Pseudomonas medicaginis var. phaseolicola (Halo Blight). In two fields of snap beans in Utah County halo blight was found affecting 100% of the plants, destroying 20% of the foliage and spotting 100% of the pods remaining on the plants. The leaf lesions ranged from 0.5 - 1 mm in diameter and were surrounded by a chlorotic halo measuring from 0.5 - 1.5 cm in diameter. In a third field in the same County, dry beans (Pinkeye variety) were affected with Halo blight. Nearly all of the plants were affected and practically all of the foliage had been destroyed. A few stray plants of the Great Northern variety were not affected at all. Bacterial blight of beans in epiphytotic intensity is considered very unusual in Utah. In this case it may be associated with a series of heavy thunder showers occurring in Utah County beginning about the middle of July. Growers obtained only three pickings, where six is the usual number. Halo blight was also observed in Davis County where a few plants in one field bore a few lesions on the older leaves.

Fusarium solani f. phaseoli (F. solani var. martii f. 3) (Dry Root Rot). Dry root rot of snap beans were observed in Davis County in a single field, where 2% of the plants had been destroyed and 75% of the plants were stunted with several of the lowest leaves either dead or chlorotic. In a field of dry beans in Utah County 30% of the plants were affected with the same disease.

Virus (Mosaic). Mosaic was observed in 13 out of 17 plantings in five Counties. In Utah County 3 plantings were visited but mosaic was not observed, probably because most of the foliage had been destroyed by halo blight. It was most prevalent in Boxelder County where in one field 95% of the plants were affected. In Cache County yellow mosaic occurred in addition to the common mosaic.

PHASEOLUS LUNATUS, LIMA BEAN (3 plantings). Fusarium solani f. phaseoli (F. solani var. martii f. 3.) (Dry Root Rot). Three fields of lima beans were visited in Utah County. No disease was observed in these fields. However, a number of plants from the same County were received by Dr. Blood which were affected by a dry rot of the roots and hypocotyls. The entire root and lower stem of the affected plants were dead, dry and pithy, and a reddish-grey in color. The County Agent stated that the disease was widespread in the County and causing serious damage.

SOLANUM MELONGENA, EGGPLANT. Verticillium albo-atrum (Verticillium Wilt) Only one planting was inspected carefully, and this was free from disease. Dr. Blood states, however, that Verticillium Wilt is frequently the cause of great damage to this plant, making large scale plantings impractical.

SOLANUM TUBEROSUM, POTATO (136 plantings). Actinomyces scabies (Common Scab). Much less common scab was observed in the State than normally. Tubers being graded for shipment in Cache County ran about 2% scabby with about 0.5% more than 3/4 covered with lesions. Two storage cellars were visited in Weber and Davis Counties. Bliss Triumph and Irish Cobbler varieties in these cellars showed about 1% of the tubers with one or two lesions. Russets were generally free from scab. According to Mr. A. L. Christiansen, County Agent, this disease has caused serious losses in the past, but since then the areas where most of the disease was encountered are avoided when potatoes are planted.

(Corticium vagum). See Pellicularia filamentosa.

Corynebacterium sepedonicum (Bacterial Ring Rot). According to Mr. L. Wynn, this disease was the cause of great losses two years ago in Cache, Boxelder, and Davis Counties. Last year the disease was greatly decreased in amount, and this year it caused losses only in localized areas. He considered it of minor importance this season. This improvement may be associated with efforts to eliminate the disease from seed stocks, especially certain stocks produced locally. Approximately 100 acres of potatoes in the three counties mentioned were found to contain bacterial ring rot, ranging in amount from traces to approximately 7% in the worst case.

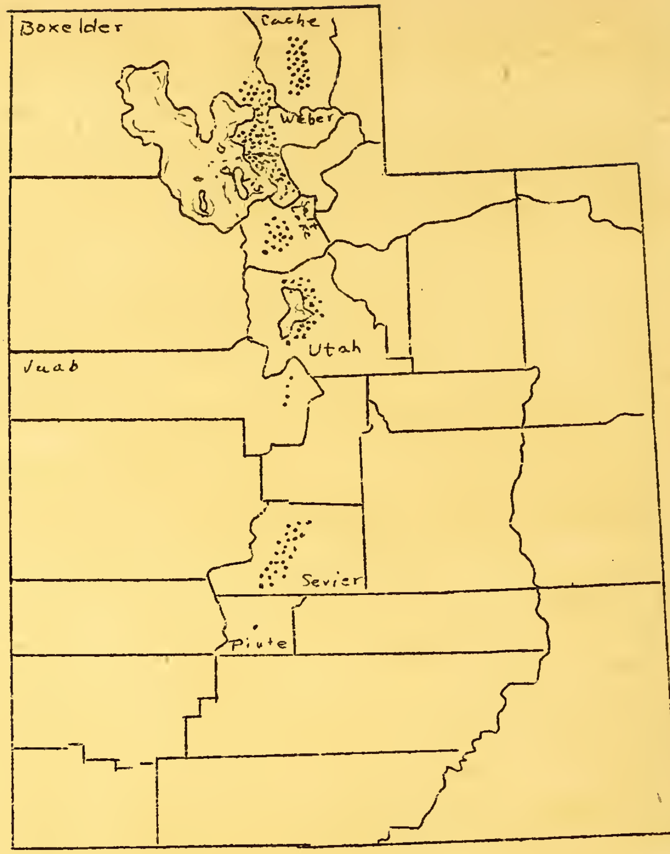
Erwinia phytophthora (Black Leg) was observed in 2 fields in Boxelder and Piute Counties, affecting 2% and 0.6% of the plants.

Fusarium spp. and Verticillium albo-atrum (Wilt). Wilt caused widespread and serious damage to the potato crop this year. It was present in all nine Counties where potato plantings were visited, and in 74% of the fields inspected. The relative importance of the several pathogens involved is difficult to determine because of the close similarity of the symptoms which they induce. The fact that vascular discoloration was limited to the lower stem and did not extend far above the soil line might be interpreted to indicate that Fusarium oxysporum was the predominant pathogen. In one field in Salt Lake County the plants were affected differently. The vascular discoloration extended into the tops of the plants and also into the pith of the stems at numerous points. This situation suggests that the pathogen in this case was Fusarium solani f. eumartii (F. eumartii).

Pellicularia filamentosa (Corticium vagum) (Rhizoctonia Disease). The stem canker phase of the disease was not observed in Utah. The presence of so much wilt tended to make the detection of this disease improbable even where it occurred. Tubers inspected in Cache, Weber, and Davis Counties, indicate that about 1% of the tubers bear a light covering of very small sclerotia, not enough to affect the grade.

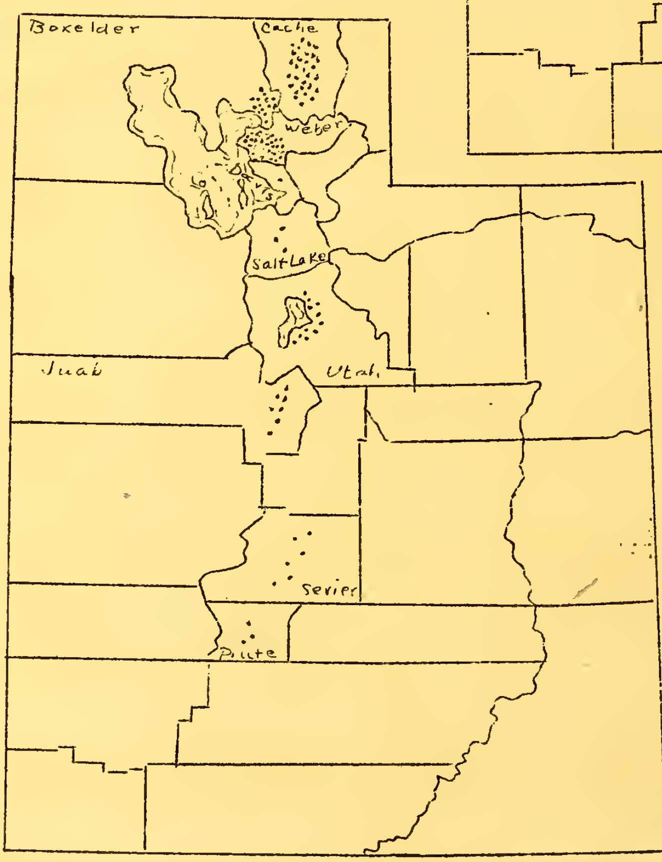
Virus (Leaf Roll). Leaf-roll was not found in the three Northernmost Counties of the State, and in Davis County, only a trace was discovered. In the central and Southern Counties the percentage of affected plants ranged from 2.35% to 5.71%.

Virus (Mosaic). Mosaic was generally present in Utah, being found in all nine Counties in which potato fields were inspected, excepting Davis County. It was, no doubt, present there also, but was not detected because of the obscuring effect of wilt symptoms. It was most prevalent in the Northern



Distribution of potato wilt in Utah, 1943.

Each dot = 0.1%



Distribution of potato virus diseases in Utah, 1943

Each dot = 0.1%

Counties, with the greatest intensity in Weber County where 35.59% of the plants were affected. The greater portion of the mosaic was of the rugose type. Numerous cases of calico were observed in Utah County, and mild mosaic was present in Sevier and Piute Counties.

Non-parasitic (Psyllid Yellows). Psyllid yellows was found in traces in Cache County, and in one field in Boxelder County where 75% of the plants were affected.

Potato diseases observed in Utah during 1943.

County	No. of fields	Acres	Percentage of plants affected				
			Wilt	Mosaic	Leaf roll	Psyllid yellows	Black leg
Cache	14	37	26.60	28.80		0.09	
Boxelder	6	45	18.89	13.89		8.33	2.00
Weber	12	32	35.59	35.59			
Davis	7	33	30.36		0.62		
Salt Lake	17	34	16.53	0.50	2.37		
Utah	54	93	22.78	6.58	4.70		
Juab	5	19	3.61	2.76	4.05		
Sevier	11	73	26.20	0.08	5.71		
Piute	10	66	0.72	0.31	2.26		0.61
Totals	136	432	20.10	8.03	1.89	0.87	0.30
Estimated loss (%)			5.26	2.40	0.60	0.25	0.10

CEREALS

AVENA SATIVA, OATS (4 plantings). Puccinia graminis (Stem Rust). Four plantings of oats, all in Cache County, were visited. Three were free from disease and the fourth contained a trace of stem rust.

HORDEUM VULGARE, BARLEY (1 planting). Erysiphe graminis (Powdery Mildew) was found affecting all but the uppermost leaves of 100% of the plants in a mixed planting with oats. The oats were not affected.

Puccinia graminis (stem rust). A trace of stem rust was also found in the field mentioned above.

Typhula spp. (Snow Rot), was not observed in 1943. Dr. Richards reports a serious outbreak of this disease in 1941 which resulted in the destruction of from 75% to 90% of the barley plantings.

MEDICAGO SATIVA, ALFALFA (21 plantings). Corynebacterium insidiosum (Bacterial Wilt) was observed in three plantings in Cache, Washington, and Sevier Counties, affecting from 1% to 4% of the plants. Dr. Richards states that bacterial wilt of alfalfa is widespread in the State and limits the profitable age of alfalfa plantings to about three years.

Cuscuta sp. (Dodder) was observed parasitizing alfalfa in two fields in Cache County and two in Washington County, affecting from a trace to 2.5% of the plants.

Peronospora trifoliorum (Downy Mildew) was found in one field in Cache County, affecting the youngest leaves of an occasional plant.

Pseudopeziza medicaginis (Leaf Spot). Some leaves of plants in 14 plantings in five different Counties were spotted. Usually only the lowest few leaves were spotted, but in one field in Washington County 75% of the foliage of all of the plants were spotted.

Pyrenopeziza medicaginis (Yellow Leaf Blotch) was seen in five fields in Cache and Boxelder Counties. In four of the fields only a trace was present. In the fifth 50% of the foliage of all of the plants was spotted.

Virus (Mosaic). Mosaic was found in four fields in Cache and Washington Counties. In two fields it was present only in traces. In the other fields 1% and 50% of the plants were affected.

Alfalfa diseases observed in Utah in 1943

County	No. of fields	Acres	Percentage of plants affected					
			Bact. wilt	Dodder	Downy mildew	Leaf spot	Leaf blotch	Mosaic
Cache	10	114.5	0.17	0.14	.001	20.1	.04	.05
Boxelder	3	25				.06	.06	
Weber	1	5	1.0			100.		
Washington	6	43	.54	.12		87.2		6.1
Sevier	1	20	4.0			100.		
Totals	21	207.5	0.62	.10	trace	41.21	.03	1.28

SORGHUM VULGARE, SORGHUM. Sphacelotheca sorghi (Covered-kernel Smut). A trace of this disease was observed in a five-acre planting in Washington County.

TRITICUM AESTIVUM, WHEAT. Erysiphe graminis (Powdery Mildew) was observed in a single planting in Cache County. A narrow strip along one side of the field, adjacent to a barley planting, was heavily covered. The barley was also affected with powdery mildew.

Puccinia graminis (Stem Rust). Mr. A. F. Bracken reports that only traces of stem rust occurred in the State this year.

Tilletia caries (T. tritici) and T. foetida (T. levis) (Covered Smut, Bunt). Mr. A. F. Bracken reports traces of both tall and short bunt this year. He associates the decrease in amount of bunt with late planting last fall, which allowed most of the plants to escape infection, and also with the increased use of bunt-resistant varieties developed at the Utah Station.

Typhula spp. (Snow Rot) was not observed in 1943. Dr. Richards reports a serious outbreak in 1941 which destroyed from 25% to 30% of the winter wheat that season.

ZEA MAYS, CORN (5 plantings). Ustilago maydis (U. zeae) (Common Smut) Five plantings of field corn were visited. In one field in Weber County 0.5% of the ears were smutted. In two plantings of sweet corn in Davis County a trace and 7% of the ears were smutted, and in two others in Washington County 3% and 30% of the ears were smutted.

FRUIT AND NUT CROPS

AMYGDALUS COMMUNIS, ALMOND (1 planting). Coryneum carpophilum (C. beijerinckii) (Shot-Hole Disease). A small planting in Washington County showed a light spotting of leaves on the lower branches. Nearby, peach trees were clean.

AMYGDALUS PERSICA, PEACH (53 plantings). Coryneum carpophilum (C. beijerinckii) (Shot-Hole Disease), was not common on peaches this year. It was observed in only one planting in Utah County, where it has defoliated the centers of a young orchard.

Non-parasitic (Iron Chlorosis). Chlorosis of peach trees due to iron deficiency was observed in all of the areas visited. It varied greatly within small areas, ranging from a trace at the ends of the shoots to nearly 100% of the foliage of whole plantings.

Non-parasitic (Sun Scald). In one orchard in Washington County 95% of the trees bore numerous cankers, ranging from 6 to 18 inches in length and from 1 to 3 inches in width, along the upper sides of the main branches. These trees had been pruned to a very open habit.

Virus (Mosaic) Dr. Richards states that this disease is still present in considerable amounts in Grand and San Juan Counties despite the fact that eradication has been carried on there for a number of years. One of the difficulties encountered has been the presence of the virus in symptomless carriers such as the apricot and Pottawatomie plums.

Virus (Western "X" Disease). This disease received special attention because information was needed on which to base recommendations for a control program. Western "X" Disease of peaches was first observed in the State by Dr. Richards in 1939. According to data collected by him, the percentage of trees affected in 9 orchards near Bountiful, Davis County, had increased from 22.4% in 1939 to 41.5% in 1943. The data for Davis County as a whole indicates somewhat lower concentration of the disease for 1943. On the other hand one orchard was surveyed in which 78% of the trees were found to be affected. The percentages for Boxelder and Davis Counties for 1943 were 22 and 29 respectively. Utah County, which is an important peach growing county, showed only 1.4% of the trees affected.

FRAGARIA, STRAWBERRY (1 planting). Mycosphaerella fragariae (Leaf Spot) A trace of leaf spot was observed in a 2-acre planting in Washington County.

MALUS SYLVESTRIS, APPLE (11 plantings). Erwinia amylovora (Fireblight) on apples was observed in Boxelder, Utah and Sevier Counties. In Boxelder County 2% of the trees were affected with 10% of the fruiting spurs killed. In Utah County it was observed on a single tree, killing about 50% of the fruiting spurs. In Sevier County 50% of the trees in an orchard were affected with 25% of the fruiting spurs killed.

Undetermined (Root Rot). A single tree in Utah County was found which was nearly dead as the result of a root rot of undetermined cause.

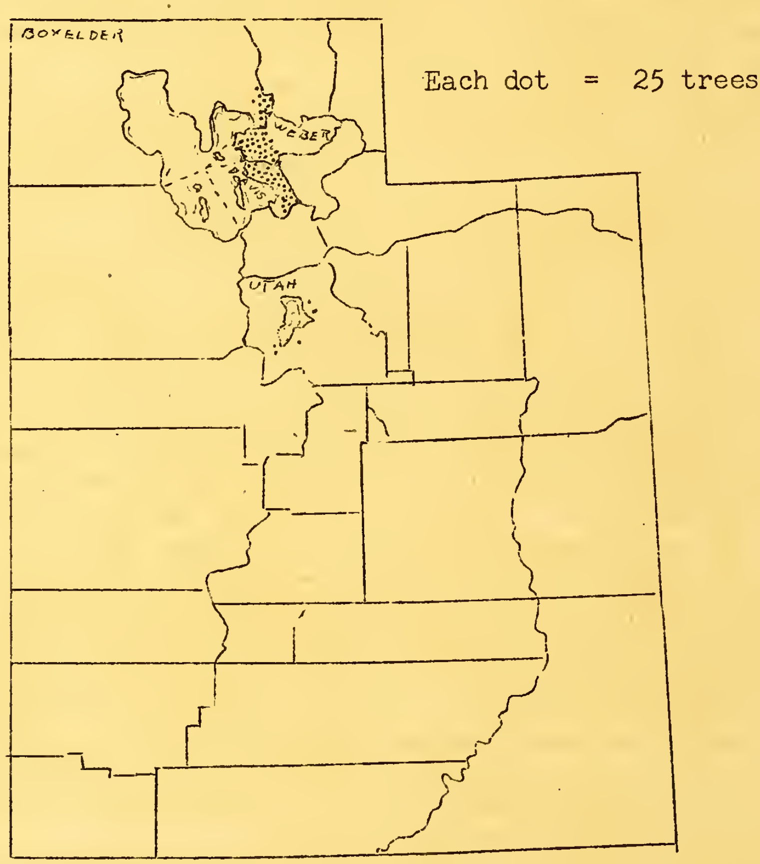
Non-parasitic (Iron Chlorosis). Iron deficiency symptoms were observed on apples in Cache, Utah, Juab, Sanpete, Sevier, and Washington Counties. It was especially severe in Sanpete County in the vicinity of Gunnison.

PRUNUS ARMENIACA, APRICOT. Coryneum carpophilum (C. beijerinckii) (Shot Hole Disease)? Shot hole disease symptoms were observed almost universally on the leaves in apricot orchards, but fruit and twig lesions were not found.

Distribution of Western "X" Disease in peach orchards of Utah, 1943.

County	No. of orchards	No. of trees	% of trees affected	Estimated Loss (%)
Boxelder	4	1,317	22.0	22.0
Davis	14	2,711	29.1	29.1
Utah	32	10,051	1.4	1.4
Washington	3	179	0.0	0.0

Distribution of Western "X" Disease
1943



Undetermined (Dieback). Dieback of twigs and branches is common, especially in neglected orchards. Several factors are very probably involved, including winter injury, wood decay fungi, and Verticillium albo-atrum. In one orchard in Boxelder County 3% of the trees had from 1% to 50% of their limbs killed back to the main trunk.

PRUNUS AVIUM, SWEET CHERRY (5 plantings). Podosphaera leucotricha (Powdery Mildew). Several trees in one orchard in Davis County were affected with powdery mildew which appeared as a mottling of the leaves on low, shaded limbs.

Non-parasitic (Iron Chlorosis). Chlorosis was observed in one planting in Washington County affecting the leaves at the tips of the shoots in 25% of the trees. The affected trees were planted near the irrigation ditch where the soil may have been waterlogged periodically.

Undetermined (Crinkle). This disease has become widely distributed in the State, very probably by means of diseased nursery stock or bud wood. In Washington County a nursery planting of approximately 400 trees was found to contain crinkle in 4.5% of the trees. Dr. Richards reports 17% of the trees affected in six orchards in this County and similar percentages in Boxelder County from an earlier survey.

Undetermined (Deep Suture Disease). Dr. Richards reports this disease in four orchards in Utah. He believes it to be generally distributed throughout the State.

Undetermined (Dieback). In one orchard in Boxelder County 90% of the trees were killed back 50% and approximately 10% of the trees had been removed. Occasional trees exhibiting dieback can be found in nearly every orchard. The etiology is not understood, but it seems evident that a number of factors are involved, including winter injury and virus diseases. In a planting along an irrigation ditch in Washington County dieback was apparently associated with root drowning.

Undetermined (Wilting Disease). The trees go down suddenly as though the main trunk had been girdled. No information was obtained this season on the distribution or intensity of this disturbance because of the presence of autumnal coloring and normal seasonal maturing. It is believed, however, that it is quite common in the Northern Counties on the basis of previous observations made by Dr. Richards. Dr. Richards has experimental evidence indicating that the trouble may be of virus origin.

Virus (Rasp-leaf). Rasp-leaf has been found by Dr. Richards in four orchards in Davis County. It was observed this season in artificially inoculated trees in his experimental plots, the diseased bud wood used in the inoculation coming from the orchards mentioned.

Virus (Ring Spot or Lace leaf of Sweet Cherry). Dr. Richards reports this disease distributed generally throughout the State.

Virus (Rusty Mottle?). Leaf and twig symptoms resembling rusty mottle of sweet cherries were observed in three plantings in the vicinity of Bountiful, Davis County. Final diagnosis of this trouble must await the time when early season symptoms and fruit symptoms may be checked. Approximately 60% of the trees were dead or dying from this disease in one orchard, while in another approximately 10% of the trees were badly affected. It was also observed in a single tree in a third orchard. There seems to be a fairly definite indication that the disease was introduced, in the first two orchards at least, through budding of diseased pollinator buds into the affected trees.

PRUNUS CERASUS, SOUR CHERRY (4 plantings). Undetermined (Dieback). Dieback is generally present and frequently causes considerable loss in individual orchards. A number of factors are involved, including winter injury and possibly virus disease (see above under sweet cherry).

Undetermined (Wilting Disease). Occasional trees wilt suddenly as though the main trunk were girdled. This disturbance is widespread in the Northern Counties and over a period of years has undoubtedly caused serious losses. Dr. Richards has experimental evidence to indicate that a virus is involved.

PRUNUS DOMESTICA, PLUM, PRUNE. Non-parasitic (Iron Chlorosis). Iron deficiency symptoms were observed in a small planting of plums in Washington County. The leaves at the tips of the shoots in 87.5% of the trees were affected.

Undetermined (leaf Spot or Mottle of Italian Prunes). This disturbance appears as a necrotic spot on the leaves, resulting in shot-hole effects and defoliation. Dr. Richards reports it widespread in the State becoming a limiting factor in the production of this crop. He states that this is one of the most destructive stone-fruit diseases in the State. Entire plantings are pulled out each year because of it.

PYRUS COMMUNIS, PEAR (3 plantings). Non-parasitic (Iron Chlorosis). Iron deficiency symptoms were observed on pear trees in Utah and Washington Counties. In one planting in Washington County 3.6% of the trees were chlorotic in 75% to 100% of the foliage.

RUBUS spp., RASPBERRY (7 plantings). Non-parasitic (Iron Chlorosis). Iron deficiency symptoms were observed in five plantings in Cache, Boxelder, and Juab Counties. In most cases only the leaves at the tips of the shoots were chlorotic and the percentage of affected canes ranged from 50 to 100.

Virus (Mosaic). In one planting in Hyrum, Cache County, 100% of the canes were affected. The mottling on the older leaves was faint. There was a tendency for the leaves to become cupped downward. There was some puckering of the leaf blades, and necrotic spots occurred in the extremely chlorotic areas. The planting was uniformly affected, indicating that the propagation was from diseased stock. Many dried fruits remained attached to the canes long after harvest was completed. The estimated loss was 50%.

VITIS spp., GRAPE. Non-parasitic (Iron Chlorosis). The two plantings visited were planted to vinifera varieties of grapes and no iron deficiency symptoms were observed in them. Dr. Wann states that the Concord variety is frequently and seriously affected when grown on its own roots.

SPECIAL CROPS

BETA VULGARIS, BEET (15 plantings). Cercospora beticola (Leaf Spot) was generally present on garden beets in the State, but not abundant or causing appreciable damage. In a one-acre planting near Willard, Boxelder County, 100% of the plants were lightly spotted.

Phytophthora sp. (Wet Root Rot), was observed in one field of sugar beets in Cache County, affecting 25% of the plants in the field. The soil was very heavy and the affected plants were in areas where the soil had been flooded at some time previous to the appearance of the disease.

Undetermined (Damping-off). In one field of sugar beets seedlings (seed crop) in Washington County 10% of the plants were missing in low, wet areas in the field, or about 2.5% of the whole planting was destroyed. Stunted seedlings bore black root lesions.

Undetermined (Crown Rot). A dark brown, firm, moist crown rot was observed affecting a few sugar beet plants in 2 different fields in Boxelder and Cache Counties.

Virus (Curly Top). The practice of planting curly-top-resistant strains of sugar beet has practically eliminated this disease as a major threat to the crop in Utah. It was observed in one field in Boxelder County where it affected 7% of the plants, in another field in Washington County where it affected a single seedling, and also in Dr. Blood's tomato breeding plots in Cache and Washington Counties where a curly-top-susceptible strain was planted, and nearly 100% of the plants were affected.

Virus (Mosaic). This disease was observed on a single sugar beet plant in Dr. Blood's tomato breeding plot in Washington County.

Sugar beet diseases observed in Utah during 1943

County	No. of fields	Acres	Percentage of plants affected				
			Wet root rot	Damping-off	Crown rot	Curly top	Mosaic
Cache	6	20.25	0.3		.01	trace	
Boxelder	2	17.00			2.9		
Weber	1	5.00					
Utah	1	8.00					
Washington	5	16.00		0.8		trace	0.03
Totals	15	66.25	.09	0.19	0.9	trace	.007

OBSERVATIONS ON PLANT DISEASES IN NEVADA DURING 1943

Seth Barton Locke

Collaborators

University of Nevada Agricultural Experiment Station
Dr. P. A. Lehenbauer
Dr. Oliver Smith

Nevada State Department of Agriculture
Mr. Schweis
Mr. Shogren

Major Pathological Problems

Bacterial Wilt of Alfalfa. This disease is the limiting factor that determines the profitable life of alfalfa stands in the State. The Nevada Experiment Station in cooperation with the Bureau of Plant Industry is con-

ducting variety tests at several points within the State in order to select strains which are well adapted to the area and also resistant to bacterial wilt.

Potato Virus Diseases. The problem of obtaining sufficient virus-free potato seed is a serious one. The State Department of Agriculture is directing part of its effort toward increasing the amount of certified seed grown within the State.

Potato Wilt. Potato wilt is a major pathological problem in Nevada. Effective control measures for this disease are badly needed.

LIST OF DISEASES REPORTED

ALLIUM CEPA, ONION. Two plantings were visited in Washoe County. No disease was found.

Botrytis spp. (Neck Rot). An occasional bulb was affected with *Botrytis* neck rot in a single storage place visited near Reno.

APIUM GRAVEOLENS, CELERY (1 planting). Virus (Mosaic). In a planting in Washoe County 2% of the plants were affected with a mosaic. Mottling and puckering of the leaf blade were the only symptoms observed.

BETA VULGARIS, BEET, CHARD (3 plantings). *Cercospora beticola* (Leaf Blight). In all table beet plantings visited the leaves were lightly spotted. Chard was free from this disease.

BRASSICA OLERACEA var. CAPITATA, CABBAGE (2 plantings). No disease was found on cabbage.

BRASSICA RAPA, TURNIP (2 plantings). *Erysiphe polygoni* (Powdery Mildew) Powdery mildew was found affecting 90% of the plants in one field in Pershing County.

Undetermined (Crown Rot). A wet crown rot of turnips was observed in one field in Washoe County affecting an occasional plant.

CICHORIUM ENDIVIA, ENDIVE. A single planting in Washoe County was found to be free from disease.

CUCURBITA MAXIMA, SQUASH. One planting near Lovelock, Pershing County, was found to be free from disease.

DAUCUS CAROTA, CARROT (2 plantings). Two plantings in Washoe County were free from disease.

MEDICAGO SATIVA, ALFALFA (5 plantings). *Corynebacterium insidiosum* (Bacterial Wilt). According to Dr. Smith, bacterial wilt is generally present wherever alfalfa is grown and limits the profitable life of the stands to about three years. This disease was seen in one field in Lyon County where it affected 3% of the plants, and also in two of Dr. Smith's test plantings.

Peronospora trifoliorum (Downy Mildew), was seen producing leaf spots on 5% and 50% of the plants in two plantings in Washoe County.

Pseudopeziza medicaginis (Leaf Spot) was present in traces in two fields in Washoe and Pershing Counties.

TRIFOLIUM PRATENSE, RED CLOVER (2 plantings). *Erysiphe polygoni* (Powdery Mildew) was present on practically all red clover seen. In two fields in Washoe County 100% of the foliage was affected.

Virus (Mosaic). Traces of mosaic were observed in one field in Washoe County.

SOLANUM TUBEROSUM, POTATO (25 plantings). Actinomyces scabies (Common Scab) was observed during the growing season only in traces in a single planting in Washoe County. Traces were also observed in one storage cellar near Reno. Mr. Shogren states that there has been very little of this disease in Nevada this year.

Fusarium spp. and Verticillium albo-atrum (Wilt). Wilt was found in all of the 5 counties visited in western Nevada, and in 80% of the fields visited. Washoe and Churchill Counties were the worst affected, having approximately 29% of the plants affected, and in some cases 100%.

Rhizoctonia solani (Rhizoctonia Disease). Rhizoctonia stem cankers were found on plantings in 3 counties in Western Nevada, but only in traces excepting in Washoe County where 100% of the plants were affected in some fields. Approximately 23% of all of the plants examined in the county were affected. Perhaps the amount was even greater because it was difficult to identify when wilt was present. Very little Black Scurf was observed on stored tubers in November.

Virus (Leaf Roll). Leaf roll was more abundant in Western Nevada than in Utah. Approximately 8% of the plants were affected, and the percentage ran as high as 12% in Pershing County near Lovelock. A single planting in Douglas County showed 25% of the plants affected with leaf roll.

Virus (Mosaic). Mosaic was much less prevalent in western Nevada than in Utah. In none of the 5 counties visited did the percentage exceed 0.25%.

Distribution of potato diseases in Western Nevada, 1943

County	Sample: Fields	Sample: Acres	Percentage of plants affected: Wilt	Rhizoctonia	Scab	Leaf roll	Mosaic
Washoe	12	52.0	28.9	23.3	0.01	0.1	0.07
Douglas	1	15.1	1.0	0.0	0.00	25.0	0.00
Churchill	3	15.5	29.2	0.0	0.00	1.6	0.07
Lyon	6	16.5	7.63	0.1	0.00	5.5	0.09
Pershing	3	100.0	0.78	0.1	0.00	12.25	0.25
Totals and average	25	199.0	12.48	6.16	----	8.65	0.15
Estimated loss (%)			2.25	1.85	----	2.60	0.06

TRITICUM AESTIVUM, WHEAT. Puccinia graminis (Stem Rust) and Tilletia caries (T. tritici) and T. foetida (T. levis) (Covered Smut, Bunt). Mr. Shogren states that only traces of these diseases were present this year.

SUMMARY OF PLANT DISEASES OBSERVED IN CALIFORNIA IN 1943

Horace L. Barnett

The following report of observations of plant diseases in California was prepared with the cooperation of all of the Plant Pathologists of the University of California and the State Department of Agriculture. A few other qualified persons have contributed several reports. Particular emphasis has been placed upon the diseases of food-producing plants. No special

effort was made to obtain or record observations of the diseases on the so-called ornamental plants. It is not intended that this report necessarily give a complete list of the plant diseases observed on these hosts during the year 1943.

VEGETABLE CROPS

ALLIUM CEPA, ONION. Peronospora destructor, downy mildew, was widespread and common, causing an estimated 25% reduction in yield. Botrytis sp., gray mold rot, was not serious. One report, from Yolo County, was received of Sclerotium bataticola, charcoal rot, occurring on the outer scales only. Aspergillus niger, black mold, was also observed.

Aster yellows (virus) occurred locally in Sonoma County; loss was slight. Yellow dwarf (virus) was observed in one location, San Pablo.

ALLIUM SCHOENOPRASUM, CHIVES. One report, from San Mateo County, was received of the occurrence of Peronospora destructor, downy mildew, on this host.

APIUM GRAVEOLENS, CELERY. Cercospora apii, early blight, was reported only from Southern California.

Fusarium oxysporum f. apii, Fusarium yellows, was scattered in occurrence and caused slight damage. Most growers use resistant varieties.

Heterodera marioni, rootknot, was scattered and of slight importance on celery.

Sclerotinia sclerotiorum, cottony rot, was also scattered in distribution and caused slight damage.

Septoria apii, late blight, was general in most areas. Copper sprays and dusts were very effective in controlling the disease, but infection was heavy where no control measures were used.

Aster yellows (virus) was general and caused losses as high as 15% in some fields.

Calico (virus) occurred in the Delta region. The percentage of infection was high in some fields but little damage resulted.

Spotted wilt, (virus) was scattered near the coast; damage was slight.

Western celery mosaic (virus) was general from the Salinas Valley northward. Especially heavy infection was observed in the Delta region. The disease was also reported from Southern California.

Blackheart due to improper moisture relations was scattered in occurrence and caused slight damage.

One report was received of boron deficiency, from San Francisco County.

APIUM GRAVEOLENS var. RAPACEUM, CELERIAC, CELERY ROOT. Local heavy infections by Septoria apii, late blight, were observed, but damage was not great. Aster yellows (virus) occurred locally in Sam Mateo County.

ASPARAGUS OFFICINALIS, ASPARAGUS. Puccinia asparagi, rust, was reported from Southern California.

BETA VULGARIS, GARDEN BEET. Infection by Cercospora beticola, leaf spot was general but light. Peronospora schachtii, downy mildew, occurred in light infections in most fields, but heavy infection was observed in a few fields of garden beets near Colma. Uromyces betae, rust, was general and abundant in most places but doing little damage. Curly top (virus) was general, especially in the interior, but infection was less severe than usual. Boron deficiency was observed causing slight loss in San Mateo County.

BETA VULGARIS var. CICLA, CHARD. Light infection by Cercospora beticola, leaf spot, occurred locally in San Mateo County. Very light infection by Peronospora schachtii, downy mildew, was observed near the coast. Uromyces betae, rust, was causing considerable loss in a few small fields near Colma, San Mateo County. Mosaic (virus) was observed in San Mateo County.

BRASSICA CHINENSIS, CHINESE CABBAGE. Cercosporella albomaculans, leaf spot, occurred locally in San Mateo County.

BRASSICA OLERACEA var. ACEPHALA, KALE. Erysiphe polygoni, powdery mildew, in local infections, Mycosphaerella brassicicola, ringspot, causing slight damage, and black ring (virus), were observed in San Mateo County.

BRASSICA OLERACEA var., BRASCHETTE. Mycosphaerella brassicicola, ringspot, and Peronospora parasitica, downy mildew, were observed in San Mateo County.

BRASSICA OLERACEA var. BOTRYTIS, BROCCOLI. Mycosphaerella brassicicola, ringspot, occurred in the coastal areas; heaviest infection was seen in the Bay region. Peronospora parasitica, downy mildew, was general near the coast, but caused little or no damage in the field. Phytophthora megasperma, root rot, was observed in San Mateo County where it caused little loss. Pseudomonas (Phytomonas) maculicola, bacterial leaf spot, occurred locally in San Mateo County on young plants. Rhizoctonia solani, wirestem, and Sclerotinia sclerotiorum, drop, were reported from Southern California. Light infection by mosaic (virus) was observed in coastal areas.

BRASSICA OLERACEA var. BOTRYTIS, CAULIFLOWER. Alternaria sp., leaf spot, occurred in scattered light infections. Mycosphaerella brassicicola, ringspot, occurred in the coastal areas; it was confined mainly to the outer leaves. Peronospora parasitica, downy mildew, was general in the coastal areas. Infection was common and moderately heavy in the plant beds but little damage was done under field conditions. Phytophthora megasperma, occurred in scattered locations where the soil is excessively wet. Appreciable loss was observed in only one field. Black ring (virus) caused slight damage in coastal areas. Mosaic (virus) was general near the coast, and was the most severe disease of cauliflower in coastal regions. The percentage of infection varied in different fields, ranging up to approximately 50%.

BRASSICA OLERACEA var. CAPITATA, CABBAGE. Light scattered infection by Botrytis sp., gray mold rot, was observed on cabbage grown for seed. Cercospora sp., leaf spot, was scattered and caused no damage. Erysiphe polygoni, powdery mildew, was generally distributed but caused no damage. Mycosphaerella brassicicola, ringspot, occurred in coastal areas. Heaviest infection was observed in San Mateo County. Mostly only outer leaves were affected. Peronospora parasitica, downy mildew, was general in coastal regions, where it was abundant in plant beds but doing little or no damage in the fields. Rhizoctonia sp., root rot, occurred locally in Yolo County, on young plants. Rhizoctonia solani, stem rot, was reported from Southern California. Scattered infection by Sclerotinia sclerotiorum, cottony rot, was observed late in the season on cabbage grown for seed. Aster yellows (virus) was scattered in distribution and caused slight loss. Black ring (virus) occurred in scattered locations in the coastal areas; loss was slight.

BRASSICA OLERACEA var. GEMMIFERA, BRUSSELS SPROUTS. Light infection by Botrytis sp., gray mold rot, was observed in one seed field in Santa

Barbara County. Peronospora parasitica, downy mildew, was coastal in distribution; apparently no damage was caused in the field. One serious outbreak of Sclerotinia sclerotiorum, cottony rot, was reported in Santa Cruz County. Black ring (virus) was observed in San Mateo County; no damage resulted. Light infection by mosaic (virus) occurred in coastal areas.

BRASSICA RAPA, TURNIP. Scattered light infections by Alternaria sp., leaf spot, and Peronospora parasitica, downy mildew, were observed on this host. Mosaic(virus), was commonly found, but little damage was done.

BRASSICA sp., MUSTARD. Erysiphe polygoni, powdery mildew, occurred on this host.

CAPSICUM FRUTESCENS, PEPPER. Alternaria sp. causing fruit spot was scattered in distribution with slight loss. Phytophthora capsici, root rot was observed in Merced County and in southern California. Rhizoctonia solani, root rot, was reported from Southern California. In one field of 50 acres near Santa Maria approximately 2% of the plants were killed or severely damaged by Sclerotinia sclerotiorum causing collar rot. Slight loss due to Verticillium albo-atrum, Verticillium wilt, was reported from Merced and Santa Barbara Counties. Occurrence of mosaic (virus) was scattered and light. The cucumber-mosaic and tobacco-mosaic viruses were reported from Southern California. Spotted wilt (virus) occurred in coastal areas; infection was heavy in some places.

CICER ARIETINUM, GARBANZO, CHICK PEA. Mosaic (virus) was observed on this host.

CICHORIUM ENDIVIA, ENDIVE. Botrytis sp., gray mold rot, was observed in the Salinas Valley. It frequently occurs on plants also infected with Sclerotinia or with aster yellows. Puccinia hieracii, rust, was observed in San Mateo County. Heavy infection with considerable loss was noted in one field, and a slight amount in some others. Sclerotinia sclerotiorum, cottony rot, occurred in the Salinas Valley; loss in one field was estimated at 10%. Aster yellows (virus) was observed in San Mateo, Monterey and Santa Barbara Counties, causing slight loss.

CICHORIUM INTYBUS, CHICORY. Spotted wilt (virus) occurred locally in the Bay region.

CITRULLUS VULGARIS, WATERMELON. Fusarium oxysporum f. niveum, Fusarium wilt, was observed in Stanislaus County.

CUCUMIS MELO, CANTALOUP. Infection by Erysiphe cichoracearum, powdery mildew, was general and moderately heavy. Considerable loss from Fusarium sp., Fusarium fruit rot, resulted in one field of Persian melons in Stanislaus County. Mosaic (virus) was scattered and of slight importance.

CUCUMIS SATIVUS, CUCUMBER. Erysiphe cichoracearum, powdery mildew,was general. Pseudoperonospora cubensis, downy mildew, was reported only from Southern California. Mosaic (aphid-transmitted virus) was scattered in the interior valleys; it was severe locally in Tulare County.

CUCURBITA MAXIMA, WINTER SQUASH. Erysiphe cichoracearum, powdery mildew, was general.

CUCURBITA PEPO, SUMMER SQUASH. Erysiphe cichoracearum, powdery mildew, was general. Pseudoperonospora cubensis, downy mildew, was reported only from Southern California. Mosaic due to an aphid-transmitted virus was scattered in distribution and caused slight loss. Mosaic due to a beetle-transmitted virus was observed in Santa Clara and San Mateo Counties.

CYNARA CARDUNCULUS, CARDOON. A trace of powdery mildew caused by Erysiphe sp. (probably E. cichoracearum) was observed in San Mateo County.

Ramularia sp. (probably R. cynarae), leaf spot, occurred on the older leaves only, in San Mateo County.

CYNARA SCOLYMUS, ARTICHOKE (GLOBE). Botrytis cinerea, gray mold rot, was reported from Santa Cruz County. Ramularia cynarae, leaf spot, was general in coastal areas; infection was moderately heavy locally but damage was slight.

DAUCUS CAROTA, CARROT. Cercospora carotae (C. apii var. carotae), blight, was scattered in distribution. Heavy infection occurred locally but total damage was slight.

Erwinia carotovora, bacterial soft rot, caused some damage to carrots grown for dehydration in the Salinas Valley. Infection followed growth cracks.

Heterodera marioni, rootknot, was generally distributed; damage was variable.

Alternaria carotae (Macrosporium carotae) blight, was scattered, occurring mostly in light infections.

Sclerotium rolfsii, southern root rot, occurred locally in Santa Clara County.

Xanthomonas (Phytomonas) carotae, bacterial blight, was general, especially in the Salinas Valley. The root infection phase of the disease is severe on shipping carrots.

Aster yellows (virus), occurred in the Bay region; it was not serious.

IPOMOEA BATATAS, SWEETPOTATO. Endoconidiophora (Ceratostomella) fimbriata, black rot, occurred generally wherever the crop is grown. It was serious early in the season in San Bernadino County. Damage due to rotted roots late in the season was not great.

Fusarium oxysporum f. batatas, stem rot, was the most serious disease of sweetpotatoes in the San Joaquin Valley. Infection was high in most fields observed near Atwater in Merced County. In several fields of Yellow Jerseys as high as 35% of the vines were either killed or rendered nonproductive. The planting of vine cuttings for the production of clean seed is being tried out.

Heterodera marioni, rootknot, was reported as serious in some fields in Merced County.

Monilochaetes infuscans, scurf, was commonly found in the San Joaquin Valley but damage was not serious.

Phoma terrestris was isolated from small "scabby" spots on the large roots from Merced County. It is not known whether the fungus is an active parasite or not.

Pythium sp., mottle necrosis, occurred locally, near Atwater in Merced County, where a few affected sweetpotaotes were collected from several fields. Loss was negligible.

Sclerotium bataticola, charcoal rot, was found in 3 fields in Merced County. Damage was not serious.

LACTUCA SATIVA, LETTUCE. Botrytis cinerea, gray mold rot, was scattered in occurrence. It was prevalent in the Salinas Valley. The disease was often associated with Sclerotinia. The amount of damage was difficult to determine.

Bremia lactucae, downy mildew, occurred in coastal areas where infection was moderate in some fields but total damage slight.

Slight infection by Marssonina panattoniana, anthracnose, was reported from Sacramento and Los Angeles Counties.

Sclerotinia sclerotiorum, drop, was general in occurrence and especial-

ly common in the Salinas Valley. As high as 15% infection was observed in some fields.

Aster yellows (virus) was general, especially near the coast. As high as 15% infection was estimated in a few fields.

Spotted wilt (virus) occurred in coastal areas; infection was light in most places.

Big vein, cause unkown, occurred in the Salinas Valley. Moderate loss was observed in a few fields; in others it was slight.

Boron deficiency caused slight damage in San Mateo County.

LACTUCA SATIVA, var., CELTUCE. Bremia lactucae, downy mildew, was reported once, from San Francisco County.

LYCOPERSICON ESCULENTUM, TOMATO. Some early infection by Alternaria solani, early blight, occurred in the plant beds. Slight infection was seen late in the season at Colma.

Slight infection by Cladosporium fulvum, leaf mold, was noted in one greenhouse at Colma.

A severe local outbreak of Corynebacterium michiganense (Phytomonas michiganensis), bacterial canker, occurred near Livermore, where the disease was also found in the plant beds. Infection was very light in some other localities.

Cuscuta campestris, dodder, was found on 3 plants in Butte County.

Fusarium oxysporum f. lycopersici, Fusarium wilt, was scattered in distribution. As high as 20% infection was observed in one field in Contra Costa County. Infection was light in most other areas.

Heterodera marioni, rootknot, was scattered and caused moderate damage in local areas.

Heavy infection by Phytophthora infestans, late blight, was observed on fruit in a few small plots near Colma late in the season; total loss was slight.

Phytophthora parasitica, buckeye rot, was not as prevalent as usual. It was found on a few fruits wet by irrigation water in Contra Costa County.

Pseudomonas tomato (Phytomonas punctulans), bacterial speck, was observed only in plant beds in Yolo County.

Pythium sp., damping-off, was general, and severe in some cases.

Rhizoctonia solani, soil rot, was found on a few fruits in Contra Costa County.

Rhizopus nigricans causing canker and fruit rot was scattered in distribution. It was more abundant than usual and was severe in a number of fields.

Psyllid yellows induced by Paratrioza cockerelli was scattered in coastal areas. Loss was not great where the disease was observed.

One plant affected by big bud (virus) was found near Brentwood in Contra Costa County.

Curly top (virus) was scattered in distribution, occurring especially in the interior valleys, and was severe locally. In one field in Kern County 30% of the plants were killed or severely damaged.

Mosaic (virus) was general.

Spotted wilt (virus) was general near the coast with scattered light infections in the interior. Attack was worse than usual. The disease was very abundant near Irvington, Milpitas, San Jose, and Salinas. A few scattered fields were a total loss. The many ornamental hosts of the virus enable it to exist in living plants in some places throughout the year.

PASTINACA SATIVA, PARSNIP. A few plants affected by aster yellows (virus) were found at Colma, San Mateo County.

PETROSELINUM CRISPUM, PARSLEY. Aster yellows (virus) was found in both the curled-leaf and straight-leaf varieties in Monterey County, in slight amounts.

PHASEOLUS LUNATUS, LIMA BEAN. Rhizoctonia solani causing root rot occurred locally on seedlings; damage was slight.

PHASEOLUS VULGARIS, BEAN. Erysiphe polygoni, powdery mildew, was general but caused slight damage. Fusarium solani f. phaseoli, dry root rot, occurred generally. It was prevalent in the coastal areas and caused loss in some cases. Heterodera marioni, rootknot, was scattered in distribution, in the southern part of the State. Pythium sp., Pythium wilt, was of slight importance in scattered locations. Rhizoctonia solani, root rot, occurred locally; it caused some damage to early plantings in coastal areas. Thielaviopsis basicola causing root rot and damping-off occurred locally and caused slight loss. Uromyces phaseoli var. typica, rust, occurred in the southern coastal districts. Mosaic (virus) was scattered in distribution. Moderate infection was observed in one field in San Joaquin County.

PISUM SATIVUM, PEA. The Ascochyta diseases caused by A. pisi, A. pinodella, and Mycosphaerella pinodes, occurred locally early in the season and caused slight damage. Cladosporium pisicola, scab, was reported from Southern California. Erysiphe polygoni, powdery mildew, was general, especially in the coastal regions, but damage was slight. Fusarium solani f. pisi, root rot, was local in occurrence. It was common on fall peas in San Benito County but damage was slight. It was also reported from Southern California. Peronospora pisi (P. viciae) was scattered in winter plantings and caused slight damage. Slight amounts of Pseudomonas (Phytomonas) pisi, bacterial blight, were reported from San Mateo and San Joaquin Counties. Rhizoctonia solani, root rot, was scattered in occurrence and caused slight damage. Scattered infection by Septoria pisi, leaf spot, occurred on winter peas. Mosaic (virus) was general in distribution. It was widespread in coastal plantings of spring and summer peas. Total damage was slight.

RAPHANUS SATIVUS, RADISH. Albugo candida, white rust, and Peronospora parasitica, downy mildew, were scattered in occurrence and of negligible importance. Boron deficiency was observed in San Mateo County.

RHEUM RHAPONTICUM, RHUBARB. Light infection by Puccinia phragmites, rust, occurred in Monterey County. Mosaic (virus) was observed locally near Hayward; damage was slight.

SOLANUM TUBEROSUM, POTATO. Actinomyces scabies, scab, was general but caused slight damage.

Alternaria solani, early blight, was scattered in occurrence and caused slight damage.

Corynebacterium sepedonicum, bacterial ringrot, was found in scattered locations. The disease appears to be spreading. An increase in amount in 1943 was thought to be due to an insufficient supply of certified seed, and present indications point to the same situation for the coming season.

Pellicularia filamentosa (Rhizoctonia solani), black scurf, was general but usually not serious.

Phytophthora infestans, late blight, occurred in scattered areas, but was severe only locally. It was common on volunteer plants in late fall and winter near Colma in San Mateo County. It was severe on above-ground

parts in some fields in Kern County. Tuber infection was not common. The fungus was also present on Solanum sarachoides, a common weed, near Colma.

Verticillium albo-atrum, Verticillium wilt, occurred locally. In several fields in San Benito County an estimated 95% of the plants were affected.

Mosaic (virus) was general but usually not serious.

SPINACIA OLERACEA, SPINACH. Heterosporium variabile, leaf spot, was observed in scattered locations. It was common near Gilroy. Damage was slight. Peronospora effusa, downy mildew, was general in the coastal areas and severe locally. Heavy infection was observed in some fields in the Salinas Valley. Mosaic (virus) occurred to a slight extent. A slight amount of spotted wilt (virus) was observed at San Pablo.

TRAGOPOGON PORRIFOLIUS, SALSIFY. At Colma light infection by Albugo tragopogonis, white rust, was noted, and a few plants affected by aster yellows (virus) were found.

VICIA FABA, HORSE BEAN. Mosaic (virus) occurred on horse bean. Spotted wilt (virus) was noted causing slight damage at San Pablo. A scab on the pods, of unknown cause, occurred locally in Alameda and Contra Costa Counties; loss was slight.

VIGNA SINENSIS, COWPEA, BLACKEYE BEAN. Erysiphe polygoni, powdery mildew, occurred locally and caused slight damage. Fusarium oxysporum f. tracheiphilum, Fusarium wilt, was observed in Merced and Stanislaus Counties. The disease was more abundant than usual and caused heavy loss in some fields. Fusarium solani f. phaseoli, root rot, was local in occurrence and caused slight loss. Heterodera marioni, rootknot, was local and of moderate importance. Rhizoctonia solani, root rot, was general but caused slight damage. Sclerotium bataticola, charcoal stem rot, was observed on this host in Stanislaus and Merced Counties; damage was slight. Verticillium albo-atrum, Verticillium wilt, was reported from Merced County.

CEREALS AND FORAGE CROPS

AVENA SATIVA, OAT. Puccinia coronata, crown rust, and P. graminis var. avenae, stem rust, caused moderate and slight losses, respectively, in the Sacramento Valley.

HORDEUM VULGARE, BARLEY. Erysiphe graminis, powdery mildew, was general but not serious. More foot rot due to Gibberella zeae (G. saubinetii) was noted than usually occurs. Helminthosporium gramineum, stripe, was found in 1/4 of the barley fields in the Sacramento Valley; damage was moderate. H. sativum, foot rot, and H. teres, net blotch, were scattered in occurrence. Ophiobolus graminis, take-all, foot rot, caused moderate damage in one area in Solano County. Rhynchosporium secalis, scald, was general and moderately severe. Ustilago jensenii (U. hordei) covered smut, was reported in 12 fields in the Sacramento Valley; infection ranged as high as 15%.

LINUM USITATISSIMUM, FLAX. Colletotrichum linicolum, anthracnose, occurs generally where flax is grown; in 1943 there was less than usual. Mycosphaerella linorum (Phlyctaena linicola) occurs locally in Fresno County. More than usual was noted; infection was moderate.

MEDICAGO SATIVA, ALFALFA. Scattered slight attacks by Cuscuta sp., dodder, were observed. Ditylenchus dipsaci, stem nematode, is scattered in

distribution. Serious attacks were noted in the Antelope Valley in Los Angeles County. Fusarium oxysporum f. medicaginis, Fusarium wilt, occurred to a slight extent. Phymatotrichum omnivorum, root rot, occurs locally, in Imperial County. Corynebacterium insidiosum (Phytomonas insidiosa), bacterial wilt, is general and serious in the central Valleys. Pseudopeziza medicaginis, leaf spot, occurs in scattered slight amounts. Rhizoctonia solani causing root canker (reported in Phytopath. 33: 1081) occurs in Southern California. Stagonospora meliloti, crown rot, is general in distribution and of moderate importance. Uromyces striatus var. medicaginis, rust, was general in the southern part of the State. Urophlyctis alfalfae, crown rot, was of local occurrence in the coastal region, and in some places was severe.

Dwarf (virus) was general in the southern half of the San Joaquin Valley and southward. It is severe and causes heavy loss in some areas.

TRITICUM AESTIVUM, WHEAT. Gibberella zeae (G. saubinetii) occurred locally in more than usual amounts, causing moderate loss. Ophiobolus graminis, takeall, foot rot, was observed in one area, in Solano County. Puccinia graminis var. tritici, stem rust, was general. P. rubigo-vera var. tritici, leaf rust, occurred in slight amounts. A small amount of Tilletia spp., bunt, was observed; the disease is well controlled by seed treatment.

VICIA sp., VETCH. Mosaic (virus) was observed on this host.

VIGNA SINENSIS, COWPEA. See under vegetable crops.

ZEA MAYS, CORN. Fusarium moniliforme, ear mold, was general but of slight importance. Scattered light infection by Puccinia sorghi, rust, and slight damage by Ustilago maydis (U. zeae), smut, were noted.

FRUIT AND NUT CROPS

AMYGDALUS COMMUNIS, ALMOND. Armillaria mellea, root rot, was general. One report of Cladosporium carpophilum, scab, was received, from Monterey County; no damage was caused. Coryneum carpophilum (C. beijerinckii), shot hole, blossom blight, was severe, especially in the San Joaquin and Sacramento Valleys. More than the usual amount occurred. A reduction in yield amounting to 15% was reported from Southern California.

Monilinia (Sclerotinia) laxa, blossom blight, was general. Infection was usually slight, but locally it was heavy.

Sclerotinia sclerotiorum, green rot, jacket rot, was scattered in distribution and caused moderate loss.

Tranzschelia pruni-spinosae, rust, was causing some defoliation in the Salinas Valley. The disease was less prevalent than usual.

Verticillium albo-atrum, blackheart, was scattered, causing slight damage, in the San Joaquin Valley.

Phytophthora sp., canker, caused slight damage.

Agrobacterium tumefaciens, crowngall, was general. Pseudomonas syringae (Phytomonas cerasi), bacterial canker, was less prevalent than usual.

Mosaic (virus, peach-mosaic, apricot form) occurs in Southern California. It is widespread in the Banning area. The chief concern due to its presence is the possibility of spread to peach, which present records indicate is very slow if it takes place at all.

Ringspot (virus) is scattered in occurrence.

Burn, cause unknown but suggested to be due to high temperatures since it never occurs except with temperatures of 100°F or over, was reported

from Southern California.

Little leaf due to zinc deficiency is scattered in distribution in the San Joaquin Valley.

AMYGDALUS PERSICA, PEACH. Armillaria mellea, root rot, occurred in scattered locations, especially in the Sacramento Valley.

Cladosporium carpophilum, scab, was local in distribution and not serious.

Coryneum carpophilum (C. beijerinckii), blossom blight, shot hole, was general in the northern part of the San Joaquin Valley. Early fall rains were conducive to twig infection.

Monilinia fructicola and M. laxa (Sclerotinia), brown rot, twig and blossom blight, was general. Usually, no distinction is made between the diseases caused by the 2 species. M. laxa seems to be the more common.

Sphaerotheca pannosa, powdery mildew, was general in occurrence but of slight importance. In a few scattered orchards at higher elevations in Southern California 10% damage was reported.

Leaf infection by Taphrina deformans, leaf curl, was heavier than usual. Light infection was reported from Southern California.

Slight damage was caused by scattered infections of Tranzschelia pruni-spinosae, rust.

Verticillium albo-atrum, blackheart, occurred in scattered locations in the San Joaquin Valley; damage was slight.

Buckskin (virus) was scattered in distribution. It was found in 5 additional counties, but was not abundant in any.

Mosaic (virus) was found in Los Angeles, San Bernardino, San Diego, and Riverside Counties. Slightly less than 1000 new cases of mosaic were found in Southern California by inspectors. All known cases have been removed except for one orchard with approximately 375 cases.

Ringspot (virus) is general in distribution. Trees showing symptoms are always new cases since they show symptoms only one year. The virus is present in a variety of hosts and an annual spread takes place.

Yellow bud or Winters mosaic (virus) was observed locally near Winters in Solano and Yolo Counties.

Little leaf due to zinc deficiency occurred in scattered locations in the San Joaquin Valley.

Chlorosis caused by iron deficiency occurred locally.

Sims spot, cause unkown, occurred locally in San Joaquin County.

CASTANEA DENTATA, CHESTNUT. Endothia parasitica, blight, was observed in San Joaquin County. Other areas where blight has appeared now seem to be free from the disease.

CITRUS spp. (general). Penicillium digitatum and P. italicum, blue and green mold decay, were more prevalent than usual. Decay follows water spot on navel orange. Phytophthora citrophthora and P. parasitica, brown rot of fruit and gummosis, were favored by heavy rainfall and were more prevalent than usual. The development of Sclerotinia sclerotiorum, cottony rot, was favored by rainy weather following wind damage. Septoria fruit spot caused by Septoria sp. was of slight importance.

Manganese deficiency, exanthema due to copper deficiency, and mottle leaf due to zinc deficiency were of slight importance. High pH chlorosis caused by inability to assimilate iron, was also of slight importance.

There was less low temperature injury to grapefruit than usual.

CITRUS LIMONI, LEMON. Diaporthe citri, "decorticus", was of moderate importance. Trichoderma lignorum, Trichoderma rot, occurred on lemons

in storage, but was of slight importance. Endoxerosis due to water relations was also of slight importance.

CITRUS SINENSIS, ORANGE. An increased amount of fruit splitting this year favored the development of Alternaria citri, black rot, on navel oranges. Armillaria mellea, root rot, was favored by heavy rains and runoff, and more than usual was noted, on Valencia orange.

Water spot of navel oranges is caused by long rainy periods. Weather was favorable for its development but as yet it is too early in the season to estimate loss.

FICUS CARICA, FIG. Botrytis cinerea causing branch blight and fruit rot was general but not serious. Fusarium moniliforme, endosepsis, occurred generally. Pratylenchus pratensis, nematode root canker, was found in scattered locations. Mosaic (virus) was generally noted.

FRAGARIA, STRAWBERRY. Scattered infections by Mycosphaerella fragariae, leaf spot, caused slight damage. Sphaerotheca humuli, powdery mildew, was observed in the coastal area of central California. Verticillium albo-atrum, Verticillium wilt, occurred in the Salinas Valley. Yellows or xanthosis (virus) was general.

JUGLANS REGIA, PERSIAN WALNUT. Microstroma juglandis, leaf spot, was scattered in distribution and of no importance. Phytophthora cactorum, basal rot, occurred in scattered locations. One report of Rosellinia necatrix, root rot, was received, from Orange County. Xanthomonas (Phytomonas) juglandis, bacterial blight, was general and more prevalent than usual; loss was moderate.

Boron injury due to excess of boron in the soil or in irrigation water was scattered in distribution and serious in some localities. Girdle or black line, probably due to incompatibility at the graft union, was important in some orchards. Trees die at about the time they begin to bear. Little leaf due to zinc deficiency was noted in scattered locations, especially in the San Joaquin Valley.

MALUS SYLVESTRIS, APPLE. Erwinia amylovora, fireblight, was general in occurrence but of slight importance. Podosphaera leucotricha, powdery mildew, occurs wherever apples are grown, and was more important than usual in 1943, resulting in an estimated 10% reduction in yield. Rosellinia necatrix, root rot, was reported from Santa Cruz County. Venturia inaequalis, scab, occurred in more than the usual amounts in scattered locations.

Bitter pit due to unfavorable water relations was reported from Butte County. Boron and zinc deficiencies were scattered and not serious.

OLEA EUROPAEA, OLIVE. Cercospora cladosporioides, fruit spot, was reported only from San Diego County. Spots appear on the fruit while it is still green. The disease probably causes no loss on fruit either for ripe pickles or for oil.

Scattered slight infection by Cycloconium oleaginum, peacock spot, was present on fruit late in the season in Southern California.

Agrobacterium (Phytomonas) savastanoi, olive knot, was scattered in distribution and mostly of moderate importance, although heavy infections were observed locally.

Dieback due to boron deficiency was scattered and of moderate importance. Less occurs than in previous years because most growers in affected areas have applied boron to the soil.

A fruit spot of unknown cause, possibly due to climatic conditions, was reported only from San Diego County. The disease is of possible im-

portance in the manufacture of ripe pickles because of fruit discoloration. It was previously confused with the peacock spot.

PERSEA AMERICANA, AVOCADO. Phytophthora spp. caused trunk canker in Southern California. Decline and collapse occurs locally in Southern California in heavy or badly drained soils where excess water is present. The relation of parasitic organisms to the trouble is not determined.

PRUNUS ARMENIACA, APRICOT. Armillaria mellea, root rot, was general. Coryneum carpophilum (C. beijerinckii), blight, shot hole, occurred in the interior Valleys, causing moderate damage.

Monilinia laxa and M. fructicola (Sclerotinia), brown rot, blossom blight, were general, and very important, especially the blossom blight. An estimated 10% reduction in yield was reported from Southern California, where the disease seems to become more severe annually. Most of the damage on apricot is thought to be due to M. laxa.

Sclerotinia sclerotiorum, green rot, jacket rot, was more common than usual and was serious in some localities. Scattered light infection by Tranzschelia pruni-spinosae, rust, was observed.

Pseudomonas syringae (Phytomonas cerasi), bacterial canker, was scattered in distribution and less prevalent than usual.

Mosaic (virus of peach mosaic, apricot form) was general in Southern California. The virus is quite general in orchards on the west side of Hemet. Damage to apricot is slight but concern is felt over the possible spread to peach.

Little leaf due to zinc deficiency occurred in scattered locations especially in the San Joaquin Valley.

Tumor of unknown cause was observed in Santa Clara County.

PRUNUS sp., CHERRY. Scattered infection by Coccomyces hiemalis, leaf spot, caused slight damage in Solano and Napa Counties. Monilinia laxa and M. fructicola (Sclerotinia), brown rot, blossom blight, were scattered and less than usual in prevalence. Only a few cases of appreciable loss were noted. The fruit rot phase is of more importance than the blossom blight phase on cherry.

Pseudomonas syringae (Phytomonas cerasi), bacterial canker, was scattered in occurrence and of slight importance.

The virus diseases buckskin and crinkle caused slight damage. Buckskin was observed in Solano and Napa Counties; crinkle occurred generally.

Chlorosis due to iron deficiency was local and of slight importance. Little leaf due to zinc deficiency was scattered in occurrence.

PRUNUS DOMESTICA, PRUNE, PLUM. Armillaria mellea, root rot, was severe in the Santa Clara Valley. Monilinia laxa and M. fructicola (Sclerotinia) causing brown rot and blossom blight were prevalent in Sonoma and Santa Clara Counties; damage was moderate. Pseudomonas syringae (Phytomonas cerasi) bacterial canker, was scattered in distribution and caused slight to moderate damage. Light infection by Tranzschelia pruni-spinosae, rust, was observed in the Santa Clara Valley.

Diamond canker, probably due to a virus, occurred in Santa Clara and Alameda Counties.

Dieback caused by potassium deficiency was serious in the local areas where it occurs. Little leaf due to zinc deficiency was observed in scattered locations.

PYRUS COMMUNIS, PEAR. Erwinia amylovora, fireblight, was general but less than usual in prevalence. No serious outbreaks occurred this year.

Monilinia fructicola and M. laxa (Sclerotinia), brown rot, were found occasionally but damage was small. Pseudomonas (Phytomonas) syringae, blast, was scattered in distribution and of slight importance. Venturia pyrina, scab, occurred in scattered locations. It was more severe than usual, particularly in the coastal counties. It was also troublesome in the foothills.

Fruit pitting due to virus was reported from Eldorado County.

Black end, associated with the use of Oriental rootstocks, was of slight importance. Chlorosis due to iron deficiency was observed in scattered locations in Santa Clara and Contra Costa Counties.

RUBUS spp., DEWBERRY, YOUNGBERRY, BOYSENBERRY. Scattered infection by Elsinoë veneta, anthracnose, was noted. One plant affected by Leptosphaeria coniothyrium, cane blight, was observed in Santa Cruz County. Septoria rubi, leaf and cane spot, was general. Verticillium albo-atrum, Verticillium wilt, occurred locally, in Santa Cruz County.

VITIS CALIFORNICA, WILD GRAPE. Plasmopara viticola, downy mildew, was collected in Eldorado County. This disease has never been found on cultivated grape in California.

VITIS VINIFERA, GRAPE. Armillaria mellea, root rot, was scattered in occurrence and not serious on grape. Botrytis cinerea, fruit rot, occurred generally in less than usual amounts. Cryptosporella viticola, dead arm, occurred locally, especially in Sacramento County. It was of moderate importance.

Pure cultures of a Diplodia causing fruit rot were obtained from several mummied fruits from Tulare County. Only the hyaline one-celled Macrophoma spores were present on the fruit.

Uncinula necator, powdery mildew, was general, causing moderate loss. It is usually well controlled.

Pierce's disease (virus), is general throughout the grape-growing sections of the State. Especially heavy infection occurs in the southern part of the San Joaquin Valley. Loss from the disease is heavy. It threatens to wipe out a number of vineyards unless the diseased vines are replaced.

Black measles, cause unknown, was general and of moderate importance.

Little leaf due to zinc deficiency was scattered in occurrence and caused slight damage.

SPECIAL CROPS

ATROPA BELLADONNA, BELLADONNA. Phytophthora parasitica, root rot, and Verticillium albo-atrum, wilt, were reported from Southern California.

BETA VULGARIS, SUGAR BEET. Scattered slight infection by Aphanomyces cochlioides, seedling root rot, was observed. Light infection by Peronospora schachtii, downy mildew, occurred in most fields. Phoma betae, leaf spot, stem spot, was not causing loss in commercial plantings but threatened to be serious on the seed crops, causing loss from damping-off. Rhizoctonia solani, dry rot canker, was scattered in occurrence. Loss in one field was 50%; very light loss was observed in other fields. Scattered slight attacks by Sclerotium bataticola, charcoal rot, occurred in the interior Valleys. S. rolfsii, southern root rot, was scattered in distribution. In most fields infection was light, but heavy loss was reported in one field. Uromyces betae, rust, was general and abundant in most places but was doing little damage. Curly top (virus) was generally

distributed, especially in the interior, but infection was less than usual. Infection by mosaic (virus) was scattered and light. Slight loss from boron deficiency occurred locally in San Mateo County.

BORAGO OFFICINALIS, BORAGE. Ramularia sp., leaf spot, was observed in San Mateo County.

GOSSYPIUM, COTTON. Verticillium albo-atrum, Verticillium wilt, was observed in the San Joaquin Valley.

HUMULUS LUPULUS, HOP. Infection by Pseudoperonospora humuli, downy mildew, was local and less than usual.

MENTHA sp., MINT. Puccinia menthae, rust, was observed at Berkeley.

MISCELLANEOUS PLANTS

ACER. Rhytisma punctatum, speckled tar spot, occurred locally on A. macrophyllum. One report of R. acerinum, tar spot, on A. saccharinum, was received from Mendocino County.

ANTIRRHINUM MAJUS. Peronospora antirrhini, downy mildew, was observed on young plants in the Bay region. Puccinia antirrhini, rust, was general.

AZALEA. Botrytis sp., flower blight, occurred in scattered locations. Exobasidium vaccinii, leaf curl, was reported in San Diego County. Ovulinia azaleae, flower blight, was serious in scattered places, mostly southern. Septoria azaleae, leaf spot, occurred in scattered locations.

BEGONIA. Xanthomonas (Phytomonas) begoniae, bacterial leaf spot, was general.

CALCEOLARIA. Spotted wilt (virus) was reported from the Bay region.

CAMELLIA. Botrytis sp., flower rot, and Sclerotinia camelliae, flower spot, were scattered in nurseries.

DAHLIA. Mosaic (virus) was general. Spotted wilt (virus) occurred in coastal regions.

DICHONDRA REPENS. Sclerotium rolfsii, southern root rot, was reported from Ventura County.

DORONICUM PLANTAGINEUM. Erysiphe sp., powdery mildew, was reported fro Berkeley.

EUCALYPTUS GLOBULUS. Polyporus sulphureus, heart rot, was scattered in distribution. Damage is difficult to determine: the fungus weakens the trees which are then more easily blown over.

GLADIOLUS. Fusarium oxysporum f. gladioli, Fusarium rot; Penicillium gladioli, Penicillium rot; and Pseudomonas (Phytomonas) marginata, scab; occurred generally.

IRIS. Heterosporium gracile, leaf spot, was general.

LIGUSTRUM. Rosellinia necatrix, root rot, was reported from Marin, Sar Joaquin, and Riverside Counties.

LILIUM LONGIFLORUM var. EXIMIUM. Botrytis elliptica, blight, occurred. Mosaic (virus) was reported from Humboldt County, and yellow flat (virus) from Humboldt and Del Norte Counties.

NARCISSUS. Fusarium sp., basal rot, and Stagonospora curtisii, leaf scorch, were general.

ORNITHOGALUM. Sclerotium rolfsii, root rot, was reported once, from Los Angeles County.

PELARGONIUM PELTATUM. Xanthomonas (Phytomonas) pelargonii, leaf spot, was reported only from Sacramento County.

PHOTINIA. Erwinia amylovora, fireblight, and Fusicladium photinicola, scab, were general.

PLATANUS. Gnomonia veneta, anthracnose, was general and moderately severe in the spring. Stigmina platani, leaf spot, was reported from Santa Clara County.

POPULUS. Marssonia populi, leaf spot, was general. Taphrina aurea, leaf blister, was reported from Placer County.

PRIMULA. Pseudomonas (Phytomonas) primulae, bacterial leaf spot, occurred locally, at Colma.

ROSA. Agrobacterium tumefaciens, crowngall, Leptosphaeria coniothyrium (Coniothyrium fuckelii), stem canker, and Sphaerotheca pannosa, powdery mildew, occurred generally on roses. Diplocarpon rosae, black spot, was also general in moist regions. Phragmidium sp., rust, occurred generally but especially near the coast.

SCHINUS MOLLE. Armillaria mellea, root rot, was general on pepper trees in southern California. Fomes applanatus, heart rot, was scattered in distribution.

TROPAEOLUM MAJUS. Nasturtium is generally infected by the spotted wilt virus near the coast, growing the year round and commonly carrying the virus.

ZANTEDESCHIA. Infection by Erwinia aroideae, soft rot, was scattered and moderate. Phytophthora richardiae, root rot, was scattered in distribution. Spotted wilt (virus) occurred in coastal areas. Calla is possibly important as a carry-over host of this virus.

ZINNIA. Erysiphe cichoracearum, powdery mildew, was general. Spotted wilt (virus), occurred locally, in the Bay Region.

VEGETABLE DISEASES OBSERVED IN SOUTHERN CALIFORNIA DURING THE WINTER SEASON OF 1943-1944

Seth Barton Locke

Collaborators in these surveys were Dr. Kenneth Baker of the University of California, Los Angeles, Dr. John Middleton, University of California, Riverside, and Dr. Wm. C. Snyder, University of California, Berkeley.

ALLIUM CEPA, ONION. Thirteen plantings for seed in the Imperial Valley were visited at intervals from mid-December through mid-March. No disease was found. Plantings visited elsewhere in Southern California were also free from disease.

ALLIUM PORRUM, LEEK. One large planting visited in December near Lompoc and another near Palm City were both free from disease.

APIUM GRAVEOLENS, CELERY. Traces of Fusarium yellows (F. oxysporum f. apii) (F. orthoceras var. apii) to 0.3% infection, and traces to 4% of pink rot (Sclerotinia sclerotiorum) were observed in plantings near Chula Vista. Septoria apii (late blight) was abundant in the coastal valleys, causing serious damage to the foliage where no control measures were used. Intensity ranged from traces to destruction of 50% of the foliage.

BETA VULGARIS, BEET AND CHARD. In the coastal valleys table beets were generally affected with leaf spot (Cercospora beticola) although not with sufficient severity to cause appreciable damage. Downy mildew (Peronospora schachtii) was observed in December in a planting of chard near

Lompoc, affecting from 1 to 2% of the plants. Rust (*Uromyces betae*) was observed in infections ranging from a trace to very abundant on table beet in the coastal valleys from Lompoc to Palm City, from mid-December to earl March. Traces of curly top (virus) were seen in December in a planting of table beets near Arroyo Grande.

BRASSICA OLERACEA var. BOTRYTIS, BROCCOLI. *Alternaria brassicae* (A. herculea, gray leaf spot) was observed in severe form near Guadalupe in December, affecting 100% of the plants. Traces were observed in many plan ings thereafter, but the disease did not appear in severe form again until early in March, when it caused 25% defoliation in a planting near Lompoc. *Paronosopora parasitica* (downy mildew) was common in the coastal valleys, occurring in amounts ranging from trace to abundant and causing defoliatio in isolated cases.

Heavy rains in late February and early March flooded many fields in the vicinity of Palm City. In 2 plantings 30% of the plants were dying from an undetermined root rot.

Traces of aster yellows (virus) were observed in a planting near Guadalupe, and of mosaic (virus) near Palm City and Lompoc.

BRASSICA OLERACEA var. BOTRYTIS, CAULIFLOWER. *Albugo candida* (white rust was observed as old inactive lesions on seed stalks of an abandoned planting near Lompoc. No active lesions were seen.

Alternaria brassicae (A. herculea, gray leaf spot) appeared only as an occasional lesion on old leaves until the last week in February, when it became abundant on old and young foliage in the vicinity of Lompoc and Guadalupe and increased somewhat in the Mission Valley and Palm City districts.

Peronospora parasitica (downy mildew) was present in all of the coastal valleys. Usually it appeared on the oldest leaves in young plantings and increased in severity with the age of the planting. In the most severe cases from 75 to 100% of the plants were affected. In 2 old, abandoned plantings the organism had become systemic in the curds.

Phytophthora megasperma (root rot) destroyed about 10% of the plants in 4 plantings on very wet land near El Monte.

Aster yellows (virus) was observed in small amounts near Guadalupe in December and near Palm City in January. Black ring (virus) was seen on a single plant near Compton in December. Mosaic (virus) was the most destructive disease observed on this crop. Intensity ranged from traces in young plantings to 100% infection in the worst instances.

BRASSICA OLERACEA var. CAPITATA, CABBAGE. *Alternaria brassicae* (A. herculea, gray leaf spot) was observed on the oldest leaves near the ground. It did not affect production seriously. *Botrytis cinerea* (gray mold rot) was observed on an old planting near Lompoc in December, rotting the leaves affecting the heads, and invading the stems near the soil. *Peronospora parasitica* (downy mildew) was commonly present in the coastal valleys and appeared in the Imperial Valley in mid-February. The old leaves were frequently heavily attacked and the outer leaves of the heads were sometimes spotted. From traces to 10% of the plants were affected by mosaic (virus) in the coastal valleys.

BRASSICA OLERACEA var. GEMMIFERA, BRUSSELS SPROUTS. The terminal sprouts of a planting near Pismo Beach were affected by *Botrytis cinerea* (gray mold rot) in a few cases. A trace of mosaic (virus) was observed near Pismo Beach.

BRASSICA RAPA, TURNIP. Alternaria brassicae (A. herculea, gray leaf spot) was very abundant in a planting near Palm City, observed in March.

CAPSICUM FRUTESCENS, PEPPER. Phytophthora capsici (root rot) was observed affecting from 3 to 5% of the plants in a planting near Palm City. Verticillium albo-atrum (wilt) affected from 3 to 5% of the plants in planting near National City. About 30% of the plants in an old abandoned planting near San Juan Capistrano were affected by mosaic (virus).

CICHORIUM ENDIVIA, ENDIVE. In a field near Lompoc, observed in March following heavy rains, from 3 to 5% of the plants were rotted to the ground by Botrytis cinerea (gray mold rot). A trace and 5%, respectively, of the plants in 2 plantings near Guadalupe and Lompoc were affected by Sclerotinia sclerotiorum (drop).

CUCURBITA PEPO, SUMMER SQUASH. Erysiphe cichoracearum (powdery mildew) almost completely defoliated an old planting near Oceanside. A young planting nearby that was dusted with sulfur was free from disease. An occasional plant in a planting near Venice was affected by mosaic (virus).

CYNARA SCOLYMUS, ARTICHOKE. A planting near Lompoc on very wet soil showed 5% of the plants affected by Phytophthora megasperma (root rot). In 3 plantings near Guadalupe and Lompoc 10% of the plants were severely defoliated by Ramularia cynarae (leaf spot), with flower stalks and heads damaged in some cases.

DAUCUS CAROTA, CARROT. Cercospora carotae (leaf blight) was commonly present in the coastal valleys. In one planting near Ventura the foliage was badly damaged. An undetermined root rot corresponding closely in appearance to that caused by Phytophthora megasperma was seen affecting 100% of the roots in a planting on wet heavy soil near El Monte.

LACTUCA SATIVA, LETTUCE. Botrytis cinerea (gray mold rot) was observed in small amounts near Palm City, and in another field near Arroyo Grande was found affecting 50% of the heads. Bremia lactucae (downy mildew) did not appear in coastal valleys until mid-February and in the Imperial Valley until early March. It became abundant in the coastal valleys by early March. Erwinia carotovora (bacterial soft rot) caused considerable damage near Ventura following injury from frost and drying winds. Sclerotinia sclerotiorum (drop) occurred in traces late in January in the coastal valleys. In early March it was present in the Imperial Valley, affecting 1% of the plants in some cases. One field near Arroyo Grande was 5% affected in early March. Mosaic (virus) was observed in traces in San Diego and Imperial Counties.

LYCOPERSICON ESCULENTUM, TOMATO. Alternaria solani (early blight) was abundant in old plantings in the Coastal valleys. Phytophthora infestans (late blight) was observed causing fruit rot in old plantings near Vista, and probably was responsible for most of the defoliation there. Septoria lycopersici (leaf spot) was found in a single planting near Oceanside, where it was very abundant on the foliage. Traces of Verticillium albo-atrum (wilt) were observed in plantings near Palm City. Curly top (virus) was observed affecting about 30% of the plants in an old planting near Arroyo Grande and also in small amounts in early plantings in the Imperial Valley. Double-virus streak was abundant in a large planting of staked tomatoes near Arroyo Grande. Traces of spotted wilt (virus) were observed in plantings near Palm City.

PHASEOLUS VULGARIS, BEAN. Erysiphe polygoni (powdery mildew) was observed affecting 100% of the plants in a planting near Chula Vista. Rhizoctonia solani (root rot) affected occasional plants in a small planting near

Chula Vista.

PISUM SATIVUM, PEA. Ascochyta spp. (Ascochyta blight) appeared on the lower leaves of most of the plants in one planting near Venice and in traces elsewhere in the coastal valleys. Cladosporium pisicola (scab) was observed in traces on leaves and pods in the coastal valleys. Erysiphe polygoni (powdery mildew) was found in an old, abandoned planting in the Imperial Valley.

Fusarium oxysporum f. pisi race 1 (F. orthoceras var. pisi) (Fusarium wilt) affected 2% of the plants in a field near Chula Vista. F. oxysporum f. pisi race 2 (F. oxysporum f. 8) (near wilt) was identified by Dr. W. C. Snyder in 2 plants of one lot sent from the Niland district. F. solani f. pisi (Fusarium root rot) was causing serious losses in the Niland district of the Imperial Valley, where peas have been cropped repeatedly on the sam land, for as long as 20 years in some cases. In the worst-affected fields 75% of the plants had been killed by mid-February.

Pythium sp. (root rot) was present in the Niland district, as was Rhizoctonia solani (root rot).

Mosaic (virus) was observed in a planting near Venice affecting from 5 to 10% of the plants. Less than 1% was associated with Pea Virus 1. Trac of a virus disease, not Pea Virus 1, were observed in Arroyo Grande.

RAPHANUS SATIVUS, RADISH. Plantings observed in Mission Valley were fre from disease.

SINAPIS ALBA, MUSTARD. Erysiphe polygoni (powdery mildew) was observed affecting 100% of the plants in a planting near Palm City.

SPINACIA OLERACEA, SPINACH. Peronospora effusa (downy mildew) was observed in traces in Mission Valley and near Palm City. Traces of mosaic (virus) were observed in Mission Valley.

SUMMARY OF PLANT DISEASE SURVEY IN OREGON IN 1943

Lytton W. Boyle

General Remarks

Acknowledgement is first due to the staff of State and Federal workers at the Oregon Experiment Station for certain data and observations include in the summarized notes; also to the staff of the Oregon Extension Service and Oregon State Department of Agriculture for suggestions and assistance in locating crops for observation.

Data regarding losses due to specific diseases in the State or its respective areas have been presented in a more qualitative than quantitative way. Incidents of severe losses or the relative importance of certain troubles have been noted. To obtain basic data on which to determine losses would require very detailed survey not possible in the available time. The variable nature of the areas west of the Cascades is very marked and makes a basis for estimate more difficult to obtain. Marked changes in soi and weather occur within distances where it would not be suspected. The diversity, thus the lack of continuity of certain crops, also adds to the difficulty of forming an over-all quantitative estimate. For example, one may observe a clover field badly infested with rust, and after observation of several fields conclude these to be a representative sample of the area.

Without being aware of entering a different area, upon examination of what would be suspected to be a comparable field, one may find very little rust, but mildew will predominate. One may note very little, if any, scab in samples of potatoes at a loading point; but after a short drive down an apparently level highway to the next loading point, scab may be very severe and evident to some degree on every lot of tubers.

Statistical estimates or mere judgment are both based on samples assumed to be taken within the continuous limits of a reasonably normal distribution. Whether the fields in this area would form into distributions acceptable to the statistician is a pertinent question in attempts to make estimates either by mathematical methods or by judgment.

Such great variety of areas based on ecological factors make pathological problems more confounding to the farmer, and very interesting and formidable to the specialist.

Without reference to specific diseases or crops, three types of areas exist from the standpoint of prevalence and control of plant diseases.

There are, first, relatively large areas where culture of certain crops has been intensive, but control has been cooperative since profitable production is not possible without it. When practicable methods of control are known, these are used effectively in such areas. In such areas Mr. Jones has the habit of watching Mr. Smith to see that nothing occurs that will jeopardize his crop. This helps in the early recognition of troubles.

In contrast, there are small somewhat isolated areas where certain crops have been grown intensively and continuously. This practice is tending to build up sources of inoculum that may become limiting factors in production. Rotation may be practiced in such areas in so far as control of fertility and soil inhabiting parasites are concerned, but sufficient separation does not seem possible to check the spread of air- or insect-borne inoculum effectively. In such areas the first appearances of disease are frequently overlooked by the grower since his isolation seems to have given him a false sense of security.

Diversified farming characterizes the third type of area. In such areas the first appearance of disease may not be noticed readily, or equipment and supplies suited to its control are frequently lacking when weather happens to be optimum for its development and spread. In such areas, the farmer is confronted with the problem of obtaining with a limited amount of capital, equipment suited to control of pests and diseases in his barn, his potato or tomato field, his small orchard, etc.

This summary covers primarly observations made on truck crops. At the time the survey was started, many cereal and fruit crops had been harvested, consequently the short time available could best be spent on the late truck crops developing in the fields. Data relative to the nut crops are not included since these have been summarized and reported by Dr. P. W. Miller (PDR 28:1 Jan. 1, 1944).

Truck crops

In addition to production of truck crops for market as fresh or processed vegetables, seed production is also developing along the coastal and river areas. Since many of the truck crops are biennial, this entails holding the crop either through storage or in the field during dormancy of the winter months. Additional problems due to development of disease during this dormant phase in the seed crop production are as yet not well defined

in all cases, but are being watched closely. Except when noted to be otherwise, the general observations apply only to the crops west of the Cascade Range.

ALLIUM CEPA, ONION. Botrytis sp. was evident in lesions on stems and blighted florets. It was considered to be the primary cause of a poor seed crop near Logsden (Lincoln County).

Peronospora destructor, downy mildew, was reported in 1942 to have been very prevalent and a serious problem in the western part of the State. In the current season only one specific record of the disease was made. In this instance, it was reported found in association with other fungi on the old "pipes" of plants that had yielded a poor seed crop.

Miscellaneous fungi were found on the stems and floret organs of plants that produced a light seed crop. Species of four genera of fungi (Macrosporium, Heterosporium, Stemphylium, and Ascochyta) were found on the floral organs. Macrosporium sp., Stemphylium sp., and Peronospora destructor were found in lesions on the stems.

Yellow Dwarf (virus) was recorded in only one instance in which 30% of the plants in a field in Union County were reported infected. Other fields noted in the same county were, however, described as of "excellent" health.

Malformed heads were noted on a high percentage of plants in a seed crop in Malheur County. The symptoms suggested the possibility that this might be the result of infection with aster yellows or with Dana's big bud virus. Aster yellows was very prevalent in an adjoining field of carrots.

APII-GRAVEOLENS, CELERY: Septoria apii, S. apii graveolentis, late blight, was evident in all fields of celery observed. Control practices had successfully held development of the disease in check and no serious loss was noted. In commercial plantings noted in Lane County, excellent control had been accomplished. In this area the disease was also less severe than usual in small plantings where control had been lax.

In Malheur County, one field showing approximately 10% celery yellows (virus) was recorded. The virus concerned was not specified. Traces of mosaic (calico type) (virus) were noted in same field as reported above.

Abnormal plants. Plants showing undesirable characters were evident in every locality where celery was observed. In some cases the characteristics were very suggestive of infection by a virus. In others, either virus infection or genetic variation seemed possible causes. On one type of plant, the leaves were filiform but the blister-like areas and mild mottle characteristic of infection of this host by cucumber virus 1 were not apparent. In another type the characterisitc symptom was the chlorotic mottle but no necrosis or distortion of the petioles were evident. The characteristic of a third type was a stunted, witches'-broom type of heart. Only traces of the filiform type were evident in any locality. The stunted or witches'-broom type was more common. From 10 to 20% of the plants show this character in variable degrees. The loss is dependent on the market for poorer grades of celery.

ASPARAGUS OFFICINALIS, ASPARAGUS. Root rot. An irregular condition of the plants was very marked in asparagus plots near Canby. Some plants were very green, whereas others showed various degrees of yellowing or senility. The degree of senility was correlated with evident lesions in the rhizomes. Colletotrichum sp., Penicillium sp., and a bacterium were isolated from such specimens. According to growers, only 50% of expected crop was obtain-

from such fields last spring.

BETA VULGARIS, BEETS (Table varieties). Only one record was made of scab (Actinomyces scabies). About 1/3 of plants in a field in Linn County were infected.

Leaf spot (Cercospora beticola) was generally distributed. An exception was an isolated experimental planting in Coos County. Although quite prevalent, no obvious loss was noted in either the root or seed crop.

Epicoccum sp. was found in December on leaves of plants remaining in a large garden planting in Lane County. Development had been late since root development appeared normal even though lesions were quite severe on the leaves at this date.

The occurrence of lesions of Phoma betae on seed stalks of some plants was recorded in one instance in Lincoln County.

Ramularia betae was found in leaf spots from several widely separated points. It was first recorded from Josephine County on July 12. It appeared to be more prevalent in earlier plantings when observed November 16 on the current crop to be held for seed. No apparent loss in root development was noted.

One instance of severe loss due to Sclerotium rolfsii was recorded near Scottsburg in Douglas County.

The recorded instances of occurrence of rust (Uromyces betae) on table beets during 1943 were generally distributed. Parasites are frequently found on the rust. Wide differences in susceptibility were noted between individual plants of the same variety in some lots of seed. The disease caused no apparent loss of the root crop but its importance on crops being held for seed is being watched.

Macrosporium, Stemphylium, Cladosporium, Heterosporium. Species of the foregoing genera have been noted fruiting in collections of leaf spots during the current year.

Root canker due to boron deficiency was recorded in Malheur, Multnomah, and Linn Counties.

BETA VULGARIS var., MANGELS. Cercospora beticola was prevalent but no apparent loss of root crop recorded. A crown canker was found on plants in a field near Scottsburg (Douglas County). Fusarium sp. was found in these lesions and on the roots. Only one record of Phoma sp., suspected to be Phoma betae, on mangels was made this season (Douglas County, October 3). Ramularia betae was reported from scattered points but there was no record of significant injury to the root crop. Uromyces betae was reported from scattered fields but there was no apparent loss in the root crop.

BETA VULGARIS var. CICLA, SWISS CHARD: Cercospora beticola, leaf spot, was scattered through one sizeable planting recorded in Lincoln County. Ramularia betae was recorded from two fairly large plantings in Lincoln County. "Only a scattering" was found. Uromyces betae, rust, was noted in 2 plantings in Lincoln County (November 22). Note was made of the unusual necrosis surrounding the pustules on this host.

BRASSICA CAMPESTRIS, RUTABAGA. Erysiphe polygoni was evident on every leaf in a planting in Linn County (October 18).

BRASSICA OLERACEA var. ACEPHALA, KALE. Macrosporium sp. caused black leaf spots similar to those prevalent on mature cabbage in the same area. It was not a serious problem.

BRASSICA OLERACEA var. BOTRYTIS, BROCCOLI. Traces of ringspot (Mycosphaerella brassicicola) were found on this host in Lincoln County, less

than on cabbage in same area. Traces of downy mildew (Peronospora parasitica) were noted but no severe damage was recorded.

BRASSICA OLERACEA var. BOTRYTIS, CAULIFLOWER. Black spot due to Macrosporium sp. and Alternaria circinans (Macrosporium brassicae) was prevalent in certain plantings on the coast but was found only on older mature plants and was not considered of economic importance.

Mycosphaerella brassicicola, ringspot, was reported on cauliflower planting in Lincoln County. It was found on plants of Roscoff No. 1, which has been reported to be resistant to ringspot in other areas. Only a trace of plants show clear cut symptoms due to Brassica Virus 3. Associated with this, about 25% of the plants showed necrosis of margins and along the midveins of older leaves. The midveins of the smaller inner leaves showed a distorted condition.

BRASSICA OLERACEA var. CAPITATA, CABBAGE. Botrytis cinerea was very prevalent on mature cabbage heads found standing in fields along the coast. No data was available regarding the loss if any, this may have caused in the cabbage crop. It may be a serious factor in the seed crop, however, depending on the ability of the bud to bolt without being parasitized by this fungus. Sclerotia are abundant in most instances. In some instances the fungus is evident on 100% of plants being held in the field for the seed crop.

Alternaria brassicae (Macrosporium herculeum) and Macrosporium sp., leaf spot, was quite prevalent. It probably will never be of import on the cabbage crop. It has been recorded to occur on the seed pods (Douglas County, June 15) and what role it may play in relation to the seed crop is not known.

In general only traces of Mycosphaerella brassicicola, ringspot, were noted. It was noted to occur at two new locations this season.

Injury due to Peronospora parasitica, downy mildew, was primarily on the young plants in seed beds. It was most prevalent in lower areas along coast and river bottoms. It has been observed that attack by mildew seems to make the plant more susceptible to attack by Macrosporium sp.

Plasmodiophora brassicae, club root, was prevalent on low lands along the coast. In some instances it was spread from greenhouses to Victory Gardens, causing loss of entire plantings. Some commercial plantings where crucifers have been previously grown, were estimated to be 85% infected.

Sclerotinia sclerotiorum was recorded to occur on stalk of seed crop but was causing no significant damage.

BRASSICA PEKINENSIS, CHINESE CABBAGE. A rosette type of growth was noted in scattered plants through one patch. No lesions of evident infection were noted on the plants. The symptoms are suggestive of infection by viruses on certain other hosts but the cause as yet is undetermined. Fly speck (virus) was evident on 75% of plants in a small field in Josephine County.

BRASSICA RAPA, TURNIP. Leaf spot (Cercosporella albo-maculans) has been noted on the older leaves of plants along the coast. Powdery mildew (Erysiphe polygoni) in late season has been noted on nearly 100% of leaves of certain plantings. No damage was recorded to the root crop. Leaf spot (Macrosporium sp. "giant type") was recorded but appeared to be of no economic import. Ringspot (Mycosphaerella brassicicola) was reported from Lincoln County in November.

BRASSICA sp., WILD TURNIP. Leaf spot (Alternaria brassicae) (Macrosporium herculeum) was noted on a wild host adjacent to a cabbage field.

Leaf spot (Phoma sp.) was noted in Lane County on this wild host.

CITRULLUS VULGARIS, WATERMELON. A trace of wilt (cause undetermined) was noted in one planting in Douglas County.

CUCUMIS MELO, CANTALOUP. A trace of wilt (cause undetermined) occurred in one planting in Douglas County adjacent to a planting of watermelons where a similar condition was noted.

CUCUMIS SATIVUS, CUCUMBER. Only one instance of severe loss caused by angular leaf spot (Pseudomonas lachrymans) was noted. It was prevalent in garden plantings along the coast. In most instances it occurs in late season. White pickle (virus) was noted in Multnomah County only. Less than 1% occurred in a large planting of this crop.

CUCURBITA MAXIMA, SQUASH. Only the Oidium stage of powdery mildew (Erysiphe cichoracearum) was found. The disease was prevalent on plantings in Linn County. Infection appears to have been late and it caused no obvious injury to the crop. Fruit rot (Fusarium tricinctum; Macrosporium sp.) is limited to the small late fruits on the vines. It appears the earlier formed, larger fruit make such heavy demands on the vine that the later formed fruit are weakened. The infection of the later fruits is probably more saprophytic than parasitic in nature.

DAUCUS CAROTA, CARROT. Leaf spot (Cercospora sp.) was prevalent in lower areas along coast or river bottoms. It was not severe and injury to root crop was not apparent.

Only one instance of root rot (Sclerotium rolfsii) was recorded during this year. It was very prevalent in a field in Douglas County where it was the cause of very severe injury to roots.

Leaf spot (Cladosporium sp., Heterosporium sp., Macrosporium sp., Mycosphaerella sp., and Stemphylium sp.). Two to four of the genera have been recorded as associated with leaf spots on this host. Specific tests of pathogenicity have not been made.

Aster yellows (virus) was quite general in distribution. In certain areas it was not so severe as in 1942. Reasons for the fluctuating severity of this disease are not apparent. It is generally agreed that it caused significant loss of crop, but without basic data on tonnage and quality of roots, evaluation of these losses are purely arbitrary.

Root cracks, chlorosis and necrosis of leaves. A complex of environmental factors in the soil seems the only explanation for the poor condition of several crops. In one instance in Lane County the crop from 6 acres was entirely lost. In Linn County a young crop was obviously going to yield not over 2/3 of what might be normally expected. Although bacterial rots and certain soil parasites were sometimes found associated with the poor condition of the crop, irrigation and drainage practices and soil complements appear to be primary factors.

LACTUCA SATIVA, LETTUCE. There was no opportunity to observe the effect that head rot (Botrytis sp.) may have had on the crop at time of harvest. Most fields observed had been harvested or were obviously past their prime. This rot was very prevalent on the older heads that had not been harvested for other reasons or were past their prime development.

Only one severe loss due to downy mildew (Bremia lactucae) was recorded. (Marion County March 27, 1943).

In large plantings observed in Marion and Multnomah Counties losses of 25-50% due to root rot (Sclerotinia sp.) were not uncommon. Sclerotia were evident at the base of many plants but other root parasites are suspected to have contributed to the loss. Many fields contained poorly formed heads for which the weather was commonly blamed. What part less obvious root parasites may have played is problematic.

Aster yellows (virus) was found in Marion and Multnomah Counties. Loss was not great since the disease was not evident in most fields, and 6% was the maximum infection noted in any one planting. Evidence of this virus was recorded to occur in a seed crop in Malheur County but observed too late for satisfactory specimens.

Symptoms of spotted wilt (virus) were noted to occur on the Altuce variety grown in Curry County.

LYCOPERSICON ESCULENTUM, TOMATO. Late blight (Phytophthora infestans) was generally distributed along coastal areas and along river bottoms. Severe losses were observed in many garden plantings of less than one acre. In larger commercial plantings, the disease was checked by control practices.

Soil rot of fruit caused by undetermined species of Rhizoctonia, Fusarium and Cladosporium were noted where fruit came in contact with soil.

Characteristic symptoms of wilt (Verticillium sp.) were noted in most plants of a field (Lane County) where flood water had stood during early spring. With this exception, no severe loss due to this disease was noted.

Tip blight (virus) was prevalent in trial plantings in Jackson County. It is reported to be a limiting factor in the production of this crop in this area.

Curly top (virus) was recorded to have caused severe loss (15% infection) in a planting in Curry County.

Blossom-end rot (physiogenic) was noted in irrigated areas where crop was being grown on large scale for first time. Growers were not familiar with the crop and did not regulate irrigation properly. Losses as high as 25% were noted. This loss was not serious in such areas since production was in excess of the local market or processing facilities.

PASTINACA SATIVA, PARSNIP. Leaf spot (Ramularia pastinacae) was prevalent along coast and river bottoms and was also noted on volunteer plants. It appears to be more prevalent in late season. Loss in the root crop, if any, is not obvious.

PHASEOLUS VULGARIS, BEAN. Older plants affected by root rot (Rhizoctonia sp.) showed a characteristic mottle in the lower leaves. In some fields this varied from 3 to 5%. Apparently conditions had not been most favorable for development of this disease since reduction in yields evidently due to it was reported in very few fields by growers and field men for canning companies.

In some areas no control of rust (Uromyces phaseoli var. typica) has hitherto been considered necessary, but owing to severe individual losses and to greater prevalence of the disease, the producers are gradually becoming more aware of its potentialities and much interest has been shown in its control. It seems probable that an increased amount of inoculum is gradually building up in certain areas, thus causing the disease to become more evident during the earlier season of the crop. The over all loss due to this disease is not of large proportions as yet but may readily become so if facilities are not available to check it.

In general only traces of mosaic (virus) have been noted. Exceptions to this are in instances where an adjacent field either supplies an unusual number of vectors or some unsuspected source of inoculum. Mosaic has been noted to be severe in parts of plantings adjacent to gladioli.

SOLANUM MELONGENA, EGGPLANT. Fruit rot (Ascochyta lycopersici) was noted on mature fruit in a small planting in Benton County.

Wilt (cause undetermined) was noted along river bottoms in Lane County. No large plantings of the crop were observed. It is referred to locally as "Verticillium-like" but further study is necessary to check its identity.

SOLANUM TUBEROSUM, POTATO. Scab (Actinomyces scabies) is quite prevalent but generally not severe enough to greatly reduce the grade of tubers. Potatoes from a small area in southern Klamath County were in some cases well covered with scab. Apparently the soil in this area is particularly favorable for development of the disease since a short distance away the disease was less evident or less severe when it did occur.

Losses from late blight (Phytophthora infestans) were severe in garden plantings from Multnomah to Clatsop County and south along the coast. In some home plantings losses in the field and subsequently in storage were as high as 75%. In large commercial plantings the disease control practices held loss to a minimum.

More severe injury due to Rhizoctonia (Rhizoctonia solani) was noted in the lower truck crop and bulb areas apparently on land not commonly used for this crop. The Pellicularia stage was evident on the lower stems of many plants in certain fields. Examination of tubers from certain fields in Hood River area indicate the disease may have caused significant loss. Although generally prevalent no severe losses in large plantings were noted.

Ringrot (Corynebacterium sepodonicum) was not noted during the survey of fields and storage. However, isolated cases of serious loss have been reported by inspectors. As a group producers seem to have a fear of this disease and are cooperative in checking its spread where it is discovered.

Blackleg (Erwinia phytophthora) was noted to be particularly severe in irrigated areas where improper use of water had tended to flood fields. In such fields, as high at 80% of the plants were obviously affected. In general only a small percentage of plants were obviously affected by this disease.

There was no opportunity to observe fields during the early season. Later, critical examination to determine the prevalence of virus diseases was not possible in many cases because of spray residues, masked symptoms, or presence of other diseases. Mild mosaic was prevalent and traces of calico were noted in scattered fields. Although by chance no severe cases of leaf roll were noted in the limited observation of fields, several cases were encountered during bin inspection later. The entire crop from certain fields was not marketable because of inability to separate necrotic tubers from others.

Basic data for estimate of losses due to specific diseases of the potato crop were not obtained. Growers that do not appreciate the efficacy of obtaining virus-free stock seldom are aware of the necessity for control of other common troubles. The prevalence of these diseases and magnitude of the losses they cause is perhaps best illustrated by the frequency that more progressive growers consider it necessary to obtain new foundation stocks of seed to maintain profitable yields. Although badly infested fields are obvious sources of inoculum, the source of inoculum often presents a somewhat confounding question.

SPINACIA OLERACEA, SPINACH. Leaf-spot (Heterosporium variabile) was recorded during June on the lower leaves of maturing seed crop in Lane County. No loss of crop was apparent. Blight due to Heterosporium sp. was very prevalent in December on young planting made for trial of seed crop in Coos County.

FRUIT CROPS

In addition to the more commonly prevalent diseases due to fungi and bacteria that are controlled by an intensive spray program, the development and spread of virus diseases presents new and different problems in practicable methods of control of diseases of orchard fruit. Losses due to these troubles are becoming more serious, and measures of control by registration of bud and nursery stock are being undertaken.

During contact with research workers in orchard areas, mention has been made of 12 different types of symptoms on cherries, and from 5 to 6 have been mentioned on peaches, plums, prunes, and apples. Many questions are unanswered regarding the character, spread, and methods of control of these troubles.

Several incidental observations are listed below:

AMYGDALUS PERSICA, PEACH. Brown rot (Monilinia (Sclerotinia) spp.) was observed on 100% of the fruit in an orchard (Lane County) where the spray had been lax. It was also reported to have caused blossom blight.

FRAGARIA, STRAWBERRY. Red stele (Phytophthora fragariae) has become one of the limiting factors in strawberry culture in this area. Yellows (virus) is very prevalent and a limiting factor in production of the crop.

MALUS SYLVESTRIS, APPLE. Scab (Venturia inaequalis) was very severe in small home plantings and on flowering species of crab apple where no spray program had been followed.

PRUNUS spp., CHERRY. Brown rot (Monilinia (Sclerotinia) fructicola) was reported causing fruit rot in Lane County. Leaf spot (Coccomyces (Higginsia) hiemalis) was reported in Lane County.

PRUNUS DOMESTICA, PRUNE. Rust (Tranzschelia pruni-spinosae) was observed to be very prevalent in an orchard in Linn County but occurred too late in the season to affect the crop.

PYRUS COMMUNIS, PEAR. Rust (Gymnosporangium libocedri) was reported from Lane County in June. Only traces of scab (Venturia pyrina) were noted in pear-producing areas. It was prevalent in small plantings where no spray program had apparently been followed.

RUBUS spp., RASPBERRY, BLACKBERRY. Rust (Phragmidium imitans) was observed in a late infection on raspberry that had caused no loss to the current crop. Leaf spot (Septoria rubi) was very prevalent in blackberries wherever spray program had been lax in Multnomah County.

SPECIAL CROPS

BETA VULGARIS, SUGAR BEET. Cercospora beticola, leaf spot, was prevalent but loss in the root crop was not obvious. Macrophoma sp. was recorded from Linn and Benton Counties. Severe lesions on leaves and stems of the seed crop were recorded in February. Peronospora schachtii occurred on flowers of the seed crop in only one instance (Benton County, June 18). Phoma sp. was recorded as severe on leaves of the seed crop. Further studies are

being made to determine the species. (Linn County, February 1943). Ramularia betae, during January and February, was recorded on from 60 to 100% of leaves in some instances. On the current crop only traces have been recorded as yet. In the current crop no apparent loss in root development has been recorded as due to infection by Uromyces betae.

HUMULUS LUPULUS, HOPS. There was opportunity to make only a limited survey of hop fields by either Mr. G. R. Hoerner or myself. Mr. Hoerner has kindly submitted reports he has received on about 15% of total acreage in this State, with the comment that these figures of loss are high because factors other than the particular disease mentioned are in part responsible for loss in yields.

Downy mildew (Pseudoperonospora humuli) was reported to have occurred in 3333 acres of planting. Of these 67% reported a significant crop loss, the average of which was approximately 20%.

Reports of "missing hills" (a non-specific trade term in part the result of diseases) from 932 acres average 14% loss.

Winter injury was recorded in small acreages in Marion and Polk Counties.

Sooty mold (Fumago sp. and Cladosporium sp.) are reported from a small percentage of the acreage without data regarding loss.

MISCELLANEOUS HOSTS

HELIANTHUS ANNUUS, SUNFLOWER. Stem-rot (Sclerotinia sclerotiorum) was very prevalent in small plantings noted along the coastal area.

LOLIUM PERENNE, RYE GRASS. Pullularia pullulans is causing severe loss in the area where this crop has been grown for seed. In Linn County the loss has been estimated to be approximately 85%. It is also found in Lane, Benton, Marion, Yamhill, and Clackamas Counties. (H. A. Schoth).

POPULUS sp., COTTONWOOD. Rust (Melampsora occidentalis) was noted on a few small trees in nursery in Douglas County.

RHODODENDRON OCCIDENTALE. Bud blight (Sporocybe azaleae) was very prevalent on buds of wild plants growing in woods along the southern coast.

TRIFOLIUM sp., CLOVER. Powdery mildew (Erysiphe polygoni) had not caused serious loss in white or alsike clover in Josephine County. It was very prevalent on clovers in pasture mixtures in Tillamook County. Considerable loss resulted to hay crops (red clover) in Multnomah County.

Rust (Uromyces trifolii) caused severe loss in small acreages of red clover in Multnomah County where infection was 100%.

ZEA MAYS, CORN. A trace of head smut (Sorosporium reilianum) was noted in one planting in Linn County.

ZINNIA ELEGANS, ZINNIA. Sclerotinia sp. and aster yellows (virus) were recorded in Baker County, July, 1943.

PLANT DISEASE SURVEY IN WASHINGTON, 1943

Lytton W. Boyle

Acknowledgment is first due the staff of the Washington Experiment Stations for suggestions, and the staffs of the Washington Extension Service and Washington State Department of Agriculture for suggestions and assistance in location of crops for observation.

This report includes observations made until March 1944 on the 1943 crop as it was held in storage.

VEGETABLE CROPS

APIUM GRAVEOLENS, CELERY. Leaf spot (Septoria sp.), or blight, was evident in all plantings of this crop observed. In general, control had been satisfactory. In King and Pierce Counties, this disease had made several small plantings unfit for harvest. In certain fields the result of poor coverage with the fungicides was evident by the differences in severity of the disease at regularly spaced intervals across the field.

Abnormal plants. Plants showing symptoms suggestive of virus infection were noted in every sizeable planting. In the self-bleaching types of celery, a chlorotic mottle was evident in the leaves. In both the green and self-bleaching types, a witches'-broom type of growth occurred in the heart. In severe cases this tended to form a rosette type of growth in the heart of the plant. There was a great variation between plants in the severity of symptoms. The average loss was estimated to be about 20%, depending on the market for poorer grades of celery.

BETA VULGARIS, BEETS AND MANGELS. Leaf spot (Cercospora beticola) was very prevalent on beets. Other leaf spots of undetermined cause were noted with it; apparently late-appearing since root development appeared to have been good. Specimens of beet and mangel leaves from Clallam County were well covered with rust pustules (Uromyces betae). Pustules on certain beet leaves were so parasitized that they appeared as leaf spots. (November 11).

BRASSICA OLERACEA var. CAPITATA, CABBAGE. Club root (Plasmodiophora brassicae) was very prevalent in older truck producing lands in Pierce and King Counties. An excess of lime had been placed in the soil about each plant in some fields, apparently to control this disease. In such badly infested bottom lands, it appeared questionable whether the addition of lime in this manner to the current crop had been of significant value. Excellent yields were obtained from new lands in this area producing a first crop of cabbage. These are reported to have exceeded 25 tons of kraut cabbage per acre. The crop from 15,000 Ball Head plants in Cowlitz County was not harvested because of fly speck (virus). An adjacent planting of Copenhagen Market was not affected. Plants showing veinbanding type of symptom were well scattered through a seed crop planting in Cowlitz County.

DAUCUS CAROTA, CARROTS. Black rot (Stemphylium radicinum) (Alternaria radicina) was very prevalent and causing much loss in samples observed at processing plants and in storage in Yakima and Benton Counties. In some instances losses of 50% were noted in storage. Although commonly referred to as a storage disease, canners claim this trouble was evident in the first lots of roots received last fall. This would indicate the infection may

have occurred primarily in the field before harvest. Weakening or partial breakdown of the tissues due to improper water supply to the maturing crop or to certain soil deficiencies may have been contributing factors.

Soft rots due to undetermined organisms. In Yakima and Benton Counties, it had been necessary to hold much of the carrot crop in pits or storage until after March 15, 1944. During late February and early March the weather had been comparatively temperate. This was aggravating losses due to soft rots. Sunken areas were sometimes evident in the earth covered pits where roots were stored. The ultimate loss will depend on how readily an outlet for this crop is found.

LACTUCA SATIVA, LETTUCE. Head rot (Botrytis sp.), root rot (cause undetermined), and aster yellows (virus). Most of the lettuce plantings were not observed until late October. At this time the crop had been harvested from most fields. The percentage of plants left because of rot or poor heads was very large. In some plantings, losses of 50% were observed. Botrytis rot (called slime by growers) was very prevalent. Although critical symptoms were sometimes masked by rot, etc., aster yellows was suspected to have been primarily responsible for the poor condition of a small percentage of plants. The weather is commonly held responsible for such poor crops. However, when the overall picture is considered, the primary role of somewhat intangible root parasites can not be ignored. Root rots of various degrees of severity were evident on over half the plants in some instances. The general appearance of the roots was not distinct from rot caused by Sclerotinia sp., but sclerotia were not so prevalent at this time as in some other localities where this disease had been noted. These observations were primarily based on plantings observed in King and Pierce Counties.

PHASEOLUS VULGARIS, BEANS. Dark sunken necrotic spots appeared on the beans before picking. In the field there was no evidence of mold on the pods. After picking and remaining several hours in lug boxes, growth of Botrytis mycelium from the lesions was very rapid and deterioration due to soft rot was very rapid. Approximately 7% of the pods showed infection. The necessary hand labor to cull out infected beans made processing costly and slow. (Snohomish County).

Root rot (Rhizoctonia sp.). A trial planting made as a Smith-Hughes project of the High School students was free from rust or mosaic. About 4 tons per acre were obtained without irrigation. Traces of Rhizoctonia were noted in this planting. (Cowlitz County).

Russet (cause undetermined). Near Kent in King County mention was made of rust by certain growers of beans. Examination of fields did not show evidence of rust. A russet condition of the pods was found. No organism was found associated with the trouble, and evidence of injury due to spray or mechanical rubbing of the pod against a large stem or support for the plant was lacking.

RORIPPA ARMORACIA, HORSERADISH. White rust (Albugo candida) was scattered through a planting (20 acres) near Snohomish but was not causing serious damage.

Most of the plants in a large planting near Snohomish showed symptoms, of mosaic (virus) to some degree. In extreme cases all leaves showed a "fern"type of growth. Dark streaks were apparent along the larger veins and petioles. The vascular tissue of the roots was also necrotic in severely affected plants. This was also noted in small home plantings in King and Pierce Counties.

SOLANUM TUBEROSUM, POTATO. Scab (Actinomyces scabies) was severe on certain lots of potatoes observed in storage in Clark County. These would represent only a small percentage of the total production of this county. In so far as could be determined all these lots were the result of disease aggravated by the use of barnyard manure. Growers had noticed this relation but were referring to it as "manure scab" to differentiate it from the infectious type of scab.

A light infestation of late blight (Phytophthora infestans) was noted September 7-8 in fields in Clark and Cowlitz Counties. There was no opportunity to observe the fields at a later date, but reports obtained during February indicate that conditions favored the development of this disease before harvest and yields were very materially reduced. Storage rots due to this organism were not noted in large storage cellars.

Evidence of silver scurf (Spondylocladium atrovirens) could be found on nearly every tuber in certain lots of potatoes in Skagit County. Others appeared to be entirely free of the disease. From a limited number of lots observed it would appear as if nearly one-third of the fields were infested.

Ringrot (Corynebacterium sepedonicum) was not evident in the lots of potatoes observed west of the Cascades. Growers and inspectors reported losses due to this disease in this area, however. Traces of this disease were found in 2 lots of potatoes observed at grading warehouses in Yakima County. Commercial producers of potatoes seem generally aware of this disease and seem to fear it more than others, thus are generally cooperative in its control.

Storage rots. Dry types of storage rots due to Fusarium sp. were the more common west of the Cascades. Loss due to these may approximate 6%. Wet types of storage rots were not common except in incidental cases where ventilation and temperature control had obviously been poor. In the cooler more arid area (Yakima and Benton Counties) loss due to storage rots were very low.

Internal bruise. Darkened spots of various intensity and size occurred from 1/16 to 1/2 inch beneath the surface of the tubers, rarely at the surface. Such spots were not not evident in tubers in the storage pit at the farm. After transfer to warehouse, tumbling over and off the grader, and storage in the warehouse for several days, these dark areas were evident in a large percentage of the tubers. About 3 carloads of tubers were lost in this way. Apparently the large crisp tubers could not stand the fall from the grader and the jigging necessary to settle them in the sacks before sewing.

Virus diseases. Sample fields noted in the Pioneer region of Clark County showed an average of 7% of mild mosaic. As high as 30% was noted in a field in Cowlitz County. Certain farmers refuse to try to grow the crop in this area. From observation of a few sample hills, this disease alone will probably reduce the normal yield by 25%. A comparable small planting from certified seed planted near the above field showed only 3% infected plants. Sample fields in the Pioneer region of Clark County showed from 2 to 3% current season infection of rugose mosaic. A field from home grown seed in Cowlitz County showed 15% rugose mosaic. A planting of certified seed in the same area showed none. Sample fields in the Pioneer area of Clark County showed 3 to 5% leaf roll.

Net necrosis assumed to be the result of virus infections was quite prevalent. No serious losses were observed west of the Cascades, but producers

report that such losses did occur. Certain producers comment that they believe this to be a major cause of loss, and it should be feared as much as ringrot and other diseases. Net necrosis was evident to some degree in a majority of the lots of potatoes observed in the Yakima and Benton County areas. Several lots of good size showed necrosis in 50% of the tubers. These are a total loss except as stock feed. It is estimated the yield of No. 1 grade potatoes was 22,500 tons less than would normally be expected from the acreage planted in this area.

Many producers of potatoes have learned the efficacy of using clean seed stock; but many small producers who should be producing for local markets, do not understand why some fertilizer or spray can not be used to cure these virus diseases.

SPINACIA OLERACEA, SPINACH. When fields were surveyed October 25th many had been disced into the ground. These were reported to have been lost because of downy mildew (Peronospora effusa) (P. spinaciae). Observation of stray plants missed in the cultivation indicated this to have been true. Evidence of the disease was found scattered through most fields observed. The loss will depend on how readily these may be marketed. Considerable acreage was lost in the Sammamish Valley on this account.

CEREALS, GRASSES, AND FORAGE CROPS

AGROSTIS TENUIS, BENT GRASS. A sample of seed grown near Winlock (Lewis County) contained a high percentage of sclerotia of ergot (Claviceps microcephala). (Specimen referred to herbarium for comparison).

AVENA SATIVA, OATS. No fields were observed before September 9. Most fields had been harvested. Fields noted on this date in Lewis County were badly affected by stem rust (Puccinia graminis var. avenae).

HELIANTHUS ANNUUS, SUNFLOWER. In Skagit County a planting had made excellent growth but about 20% of the stalks had fallen due to stem rot (Sclerotinia sclerotiorum). (September 17). Samples indicated that infection had been 100% in various degrees of severity on respective plants.

An extreme case of boron deficiency was noted in Clark County. In some cases the tips of the plants were black and blighted and no head was formed. In others, severe lesions extended from the head down the stem various distances. Turkeys were pastured in part of the planting. The manure from the turkeys had obviously aggravated the severity of the symptoms. Various fungi were found in the lesions but none with consistency that would indicate any primary relation to the lesions.

TRIFOLIUM PRATENSE, RED CLOVER. Attention was called to the poor condition of many plantings of red clover west of the Cascades. Rot and fungi were evident in these roots but appeared to be secondary to the infestation of insects. In fields over one year old, it was not uncommon to find the tunnels of insects in 100% of the roots observed.

FRUIT CROPS

AMYGDALUS PERSICA, PEACH. Attention was directed to a certain orchard of the Pacific Gold variety near Auburn. Much of the wood scattered through the orchard showed severe cankers. "A Cystopara sp. was readily isolated from these cankers. Dematium pullulans was also found in the canker, this however, is probably a secondary organism" (D. A. Preston). These cankers were causing severe injury to the trees. Leaf curl (Taphrina deformans) was

evident in small plantings noted in Thurston County. It had caused severe dieback on twigs. Small plantings of young trees in Thurston County were completely killed by a severe drop in temperature early in 1943.

FRAGARIA sp., STRAWBERRY. Sizeable plantings of strawberries have practically disappeared. The comment of growers and agriculturists is that red stele (Phytophthora fragariae) and yellows (virus) have made commercial production unprofitable. According to research workers on this problem, the prospects of obtaining resistant varieties with good quality fruit are encouraging.

PRUNUS DOMESTICA, PRUNE. Many prune orchards in Clark County have seen their best days. The general appearance of the trees suggested that root rot (Armillaria mellea) was the primary cause but sporophores were evident at this date for positive identification. Leaves at the top and outer branches of the tree were chlorotic and rolled. From 10 to 15% of the fruit had dropped. Large broken limbs were frequent. Mycelial wefts of perhaps a secondary organism were evident in these. In some orchards frequent replacement of trees had been made. Such replacements were not growing well and the efficacy of their use seemed questionable. Either the root rot that probably caused the loss of the original tree was checking their development, or competition with older trees was too great.

RUBUS sp., BLACKBERRY. Hendersonia rubi (Ascocarpa rubi) was noted to be prevalent in certain plantings of blackberry in Pierce County. (Observations of this crop were purely incidental at the season when survey was made).

RUBUS sp., RASPBERRY. In King and Pierce Counties where isolated plantings of the Cuthbert variety were noted, the leaves were well infected with rust (Phragmidium imitans). Lloyd George and Washington were free from this disease. Mosaic (virus) was noted on Cuthbert variety and only traces were found. It appears that growers of this variety rogue quite a number of plants. Few plantings of this susceptible variety are found.

PLANT DISEASE SURVEYS IN IDAHO 1943 - 1944

Earle C. Blodgett

Introduction

In July work was begun on the Emergency Plant Disease Prevention program in Idaho. The writer was assigned the duty of securing as accurate and complete information as possible concerning the occurrence, severity and distribution of all plant diseases on all the agricultural crops in Idaho. Later the territory was enlarged to include the 13 counties of eastern Washington and Oregon which border Idaho. Great care was taken to make the coverage of the territory as complete and accurate as possible and still conserve travel facilities.

This report summarizes the results of the surveys. For the sake of convenience the summary is divided into parts. Two parts, on fruit diseases and on onion diseases, are included in this supplement, others will be published from time to time, as completed. It should be pointed out that this summary report makes no claim for completeness nor absolute accuracy.

The report may, however, draw attention to certain factors of importance heretofore neglected.

The writer wishes to express his appreciation to all who have helped secure the information:to growers, dealers, produce inspectors, Branch Station superintendents, Extension Agents and specialists, Seed Company and Sugar Company officials and fieldmen, research workers, and others and especially to those who have critically read the manuscripts.

A great deal of credit and sincere thanks go to Dr. W. W. Ray and Mr. D. A. Preston, Emergency Plant Disease Prevention Project, Stillwater, Oklahoma, for their diagnosis and determinations on over 100 plant disease specimens (up to April 5, 1944). In the various parts of the report credit for diagnosis will be given also to others who assisted in the work.

Since the counties of Oregon and Washington bordering Idaho practice the same type of agriculture in the respective districts and the problems involved are similar. This is especially true of the Snake River Valley in southwestern Idaho and eastern Oregon. Onions, celery, beans, hay, sugar beets, carrots, many seed crops, fruit and potatoes are raised, stored, and shipped in the two states much as from a single community. This is true also in the Lewiston-Clarkston area, the Spokane-Coeur d'Alene Section, and in the Palouse area.

The cooperation of the Departments of Plant Pathology, Agricultural Experiment Stations, in Idaho, Oregon, and Washington respectively is gratefully acknowledged.

The 1943 season was characterized by a long, cool, wet spring followed by a long, dry, warm fall. Summer temperatures were not far from normal--possibly somewhat below.

PART I: FRUIT DISEASES IN IDAHO IN 1943

The following list of fruit diseases has been compiled from the records of inquiries and of field observations on the occurrence and prevalence of these diseases during 1943. Most of the notes were made during field trips of June 7 - 19, while the writer was connected with the Idaho Agricultural Experiment Station, and since July 26, in many field examinations in connection with surveys of the Emergency Plant Disease Prevention Project. The list is complete only in that it includes all diseases observed in 1943. The report is similar to those for 1936-1942, published in various volumes of the Plant Disease Reporter.

Parasitic Diseases

1. *Coryneum* blight (*Coryneum carpophilum*) (C. beijerinckii) of peach was prevalent and particularly severe on fruit in large orchards near Wendell and Buhl. These were old trees where twig cankering was very slight. The disease is particularly serious in small orchards along the Clearwater and Salmon Rivers where cankering is the predominant phase.

2. *Coryneum* blight of apricot was commonly present.

3. *Coryneum* blight was noted on sweet and sour cherries at Lewiston but damage was less than last year. Leaf spotting was prevalent in Moscow.

4. *Coryneum* blight caused extensive fruit and leaf spotting at Moscow on Italian prune. Typical cankers were noted on suckers of *Prunus cerasifera* under infected Italian prune trees. This represents the first report

of Coryneum carpophilum (C. beijerinckii) on this host in Idaho.

5. Powdery mildew (Podosphaera spp.) was noted on apple but much less severely this year.

6. Powdery mildew (Sphaerotheca mors-uvae) of gooseberry and red current was very severe on the planting at Moscow. Apparently it was more severe than usual near Craigmont also.

7. Powdery mildew (S. pannosa) on peach and nectarine was common and noted in orchards apparently not infected before. In an orchard at Emmett very severe leaf and twig infection was seen but no lesions on fruit were found.

8. Fireblight (Erwinia amylovora) on pears showed the strangest behavior ever noted in the State. In a large orchard, 20 acres or more, near Marsig a very good crop was harvested. This orchard, planted about 1934, was nearly killed out in 1936-37 by fireblight but it was left and since then has encountered mild outbreaks correlated with spring infection. Only a trace was noted in June, 1943. In September, this orchard and one at Fruitland, where frost killed all the blossoms, presented an extreme development of fireblight. Nearly all the damage was apparent after harvest time and dying of branches and whole trees occurred rapidly during September and October. The injury is so severe that saving these orchards seems impossible. Although the writer did not have an opportunity to follow the cases closely, he cannot account for the difference in behavior. The summer was extremely dry and no rainy periods occurred previous to the outbreak this fall.

9. Apple trees, particularly Jonathan, showed considerable injury from fireblight; an orchard at Franklin was severely affected by blossom blight.

10. Perennial canker (Neofabraea perennans) fruit rot was noted on Rome Beauty apple fruits at Moscow.

11. Leaf curl (Taphrina deformans) of peach was very common in northern Idaho but less prevalent than last year in southern Idaho.

12. Leaf spot, cane canker, and die back (Septoria spp.) of brambles was noted at Parma, Whitebird, Midvale, and Moscow. In some cases severe injury resulted in dying of canes.

13. Currant anthracnose (Pseudopeziza ribis) caused extensive leaf fall and fruit spotting of red currants at Moscow (plots). Again this year no infection was noted on gooseberry plants near by.

14. Strawberry leaf spot (Mycosphaerella fragariae) was noted at Tamarack.

15. Strawberry leaf scorch (Diplocarpon earliana) was also noted at Tamarack.

16. Blue mold rot (Penicillium expansum) was common on many hosts including cherry, apple, pear, and prune.

17. Black mold rot (Rhizopus nigricans) was observed on cherries, prunes, and apples. It was very severe on peaches at Wilder. Strawberries also were affected.

18. Botrytis rot (Botrytis sp.) was noted on strawberries.

19. Apple scab (Venturia inaequalis) was generally present in northern Idaho. It was very severe in many cases and did much more damage than usual.

20. Brown rot (Monilinia sp.) Sclerotinia sp.) was noted at Lewiston on cherry fruits.

21. Powdery mildew (Uncinula necator) was severe on 2 plantings near Kenrick and Juliaetta. The occurrence of this disease is not common on grape in Idaho.

22. Crown gall (Agrobacterium tumefaciens) was noted causing extensive damage to boysenberry canes near Weiser (Mann's Creek).

Non-Parasitic Diseases

1. Winter injury probably was of very minor importance. The relation of this factor to gummosis and death of young cherry and apricot trees is still undetermined.
2. Drought spot of prunes was noted but appeared to be no worse than usual.
3. Cracking of sweet cherries was noted but was not so serious this year.
4. Lime-induced chlorosis is a very important factor in tree and small fruit plantings in southern Idaho and generally is on the increase. It was noted on apples at Burley, on fruit trees at Malad, and several trees and shrubs at Preston.
5. Spray injury was not an important factor this year. In an orchard at Twin Falls, however, a grower sprayed chlorotic Jonathan trees with about 1% iron sulfate solution in the calyx stage and again later with 0.5%. Russeting was severe on some fruits and injury was rather prevalent. The trees showed much better colored foliage, however.
6. Systemic arsenic toxicity injury to peach appeared to be about as severe as last year.
7. Rosette of apples noted at Payette, Hagerman, and Malad is on the increase in these orchards.
8. Damage from frost was very severe this year. In several prune orchards fruit showed an odd, freckled appearance when the epidermis of nearly mature prunes began to loosen and scale off in spots. On apples, russet and frost bands were common. On nectarine at Emmett, deep cracks--clear to the pit--developed on fruit that had been frosted. This was the first case noted of this type of injury. Some fruit, grotesquely disfigured by frost, matured.

Virus Diseases

1. Raspberry mosaic (types not separated) was about the same as usual. One large planting of Newburgh at Georgetown showed severe mosaic infection.
2. Cherry mottle leaf was observed about usual. One Windsor tree near Caldwell showed what is believed to be mottle. Symptoms were severe and the grower reported that the tree had always been affected.
3. The original peach mottle tree was removed during the winter, but in June an apparently similar case was found in an orchard at New Plymouth. No connection between cases could be inferred. The mottle on certain peach wart trees has persisted.
4. Peach wart was present as usual and a few new cases were found, one at New Plymouth, one at Fruitland, and one at Parma.
5. The Western-X disease continued to show a spread and increase generally in severity. At the same time, its erratic behavior was apparent.
6. No new cases of rasp leaf of cherry were found.
7. Peach calico (transmissible) was observed again on the original tree where previously healthy branches showed striking fruit symptoms.
8. Leaf deformity of Italian prune (2 trees) at Fruitland noted last year has been shown to be transmissible. In general, it resembles the effects of Prunus virus 6 but causes no symptoms on peach. The late foliation of

several trees noted last year continued apparent this year.

Miscellaneous Diseases--Causes Undetermined

1. Italian Prune: (a) Leaf curl was more severe this year than last and considerable injury was noted. Some trees, however, apparently recover. (b) Leaf spot was as wide-spread as usual. In one case recovery was indicated by zinc sprays applied in the dormant stage but check trees also showed some recovery. (c) The chlorosis and malformation of prune foliage in the orchard at Weiser still persists. (d) The leaf deformity noted last year has been shown to be transmissible (see virus diseases).

2. Apricot: (a) The development of cankers on trunks and main branches was again noted and the damage was fatal to many trees. (b) Physiological spotting of fruit was noted as usual.

3. Cherry: (a) Further budding tests fail to reveal any connections between red-leaved chokecherry trees and Western-X-infected peach trees. (b) An odd ringspot pattern on sweet cherry leaves was noted at Payette. (c) A pucker-leaf condition was found in sweet cherry trees at Payette and appeared at first to be correlated with frost injury. It was seen, however, that new, young leaves showed the same symptoms. (d) Preliminary tests show that th cherry rough-bark, canker type of injury noted last year, (f) is capable of causing disturbance in young peach trees by bud inoculation. Trials are being continued. From tests completed it appears that cherry lace-leaf as known in Idaho is transmissible.

4. Peach: (a) Rough bark is very prevalent in one orchard and seems in most cases to be associated with reduced vigor. (b) Bark splitting was noted as usual. (c) Rusty spot was rare this year and the original orchard at Mesa has been removed.

5. Apple: (a) A peculiar injury to apple fruit (Delicious variety mainly) at Whitebird was noted for the second year. It appears much like drought spot (boron deficiency) on the fruit but is not typical. Boron applications and bud inoculation tests have been made. (b) A peculiar rough bark condition in definite areas on wood of a seedling apple tree, 68-15, (selected and propagated) at Parma has been observed for several years. Cankers apparently do not show up except on 3-year or older wood. Budding tests have been started.

6. Grape: The plants of Seneca and Golden Muscat at the Parma Branch Station plots showed an unidentified leaf spot that caused extensive necrosis of leaf tissue. No other varieties of several in the plots showed the condition. Probably soil differences and faulty nutrition may account for the leaf spot.

PART II: ONION DISEASES IN IDAHO

Over a period of many years market onions have been one of the most important cash crops grown in the State. Acreage and production figures for recent years are shown in the following tabulation:*

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* This information is furnished through the courtesy of the office of Richard P. Ross -- Agricultural Statistition--Boise, Idaho.

Onions	Acreage harvested	Yield sacks	Production sacks
1935-1939 Av.	2620	345	903,600
1942	3400	250	850,000
1943	3300	260	858,000

Onions are grown extensively in the Snake River Valley from Weiser to the Twin Falls area. Production of onion seed has increased very rapidly in this general area during the past 4 years and Idaho now ranks near the top. The above figures do not include bulbs planted for seed production which in 1942 involved over 1100 acres.

Inquiries on diseases and observations in the field have indicated that the growing bulb crop has been comparatively free from limiting diseases. The marked reduction in yield in 1942 and 1943 under that of 1935-39 cannot so far as known be charged, except perhaps in small measure, to the presence of parasitic diseases. Various forms of root rot have been noted on seed bulbs but in most cases, diagnosis was not possible.

Onions in storage, however, have in some cases been seriously damaged by several types of rots and during the survey, special attention was given to diagnosis of these diseases. More concern was shown during the past season because onions were stored rather longer periods for dehydration use and many bulbs were kept over for seed crop planting. These factors together with good prices and inadequate storage facilities increased interest regarding causes of the losses. Several cases were noted where damage from rots amounted to 30 or 50% of the crop stored.

The following diseases have been observed during the survey of onion storage and processing plants:

1. Neck rot. *Botrytis allii* (Confirmed by KenKnight and Ray) was the predominant and most widespread of all the rots encountered. Losses ranged from slight to well over 50% in some lots. Although no comparative determinations were possible, the yellow varieties as well as whites were severely injured. From observations it appears to the writer that *Botrytis* rot of onions is initiated either actively or potentially in the field and that crop rotation has a great deal to do with loss from this disease. Of course bulb maturity, weather conditions, handling and especially storage conditions are important factors.

2. Mycelial neck rot. (*Botrytis byssoidea*) (Diagnosed by Ray) was found on white set onions at Moscow but was not very prevalent. This apparently represents the first report of this disease from Idaho.

3. Small sclerotial neck rot. (*Botrytis squamosa*) (Diagnosed by Ray) was found sparsely in white set onions at Moscow and caused severe loss in one lot of white onions near Filer. This apparently represents the first report of this disease from Idaho.

4. Basal bulb rot (*Fusarium moniliforme*) (Diagnosed by Ray) was consistently found on decaying onions characteristically as a root or plate rot, and was peculiarly associated with a particular type of bacterium; sometimes with *Botrytis allii*. This apparently represents the first report of this disease from Idaho.

5. Penicillium rot. (*Penicillium* sp.) (Confirmed by KenKnight and Ray) was found fairly commonly and appeared to be an active parasite. So far as known this appears to be the first report of this disease from Idaho

and indications are that it's occurrence elsewhere is uncommon.

6. Black mold. (Aspergillus niger) (Diagnosed by KenKnight) was noted on bulbs collected at Fruitland.

7. Soft rot. (Erwinia carotovora) (Diagnosed by KenKnight) was noted in bulbs at the Caldwell dehydrating plant. Many of the bulbs had one to two or more leaves in a band anywhere in the bulb that were brown, water-soaked, and completely rotted. They extended from the neck to the root plate and made a striking contrast between affected and healthy tissue.

8. Sourskin. (Botrytis allii). (Diagnosed by KenKnight) (and confirmed by Ray). In the same lot noted above (under 7) many bulbs were affected by what is popularly known as sourskin. In these cases the outer scales were watery, brown, and rotted, but the inner tissues were unaffected and there was no apparent connection between sourskin and neck rot. It would appear then that considerable variation occurs in symptoms of this disease (including neck rot and sourskin, unless great differences in fungus strains occur). Double onions seemed to be particularly affected.

9. Soft, puffy rot, was noted in several cases and Ray isolated a bacterium of dirty white color that when inoculated back into onions produced a soft rot. He stated that "this bacterium may be Pseudomonas alliicola as described by Burkholder." Fusarium moniliforme also was associated in this case.

The same soft, puffy rot condition was noted rather consistently on onions that did not survive the winter (fall planted bulbs for seed production).

10. Scaly onions. This peculiar condition on onion bulbs of several varieties was seen in many storages. It was characterized by the breaking away of the scales near the root plate after which the scales turned dark and surface molds (mostly Penicillium) were common. One could sort lots by noting the darker color of scaly bulbs. In extreme cases, often accounting for 30% of the onions in a lot, the bulbs were nearly peeled and exposed the under leaves. Naturally shrinkage was more rapid and rots seemed to be more prevalent. One field had been noted August 24 near Huston where a darkening of the outer skin was recognized but no damage otherwise was noted. At Fruitland in a storage containing over 50,000 bushels, the onions from part of one lot were sorted on December 4 and each portion stored in a box. On February 16, 1944 the onions were sorted again as follows:

	Box 1 - Normal Onions	Scaly Box 2- onions
Original onions December 4	60	62
Sound onions February 16	54	48
Mild neck rot	3	7
Severe neck rot	3	7

In seed onions a great deal of concern was expressed over blasting of the heads and poor yield. Although some observations were made, indicating, as pointed out by KenKnight (PDR 28:191-198. 1944), that root rots might be involved, no conclusive evidence was found.

Several interesting cases in onion storages were noted and the most unusual seen was a large building, 1 to 3 feet off the ground, with an open slat floor in which about 30 cars of onions were stored in 50 pound mesh

sacks. No heat was available and the only protection was on the sides and roof to keep out rain and snow. When these were examined about mid-January the bulbs were frozen solid as they had experienced about 0° F in an extended cold period. At that time one sack near the entrance was examined and about 10% neck rot was noted.

On March 23 the storage was examined again and shipping was well along. The onions had kept well, thawed out gradually, and little loss had resulted. It was unnecessary to re-sort. An occasional sack showed considerable rot but much less total rot than in most storages examined.

In most cases where onions were stored in potato cellars (whether with potatoes or not) rot was severe and in a few cases approached 50% or more. From observations it would appear that more attention should be paid to onion storages in southwestern Idaho. Good facilities are not available to handle even normal-size onion crops. As rotation practices are neglected it appears likely that infection by neck rot, *Fusarium* bulb rot and other diseases are due to increase materially and unless conditions are proper, disastrous losses may occur during extended storage periods.

The writer cannot help calling attention to the dangers of introducing diseases into Idaho when onion bulbs are shipped in from many sources for seed production. Yields may be higher in some cases but from the principles of disease control the practice should be strongly discouraged and seed companies might well exert their influences to prevent introduction of out-of-State bulbs.

The experiences of some seed companies in overwintering onions, particularly Yellow Sweet Spanish bulbs, for seed production emphasizes the need for more information on and better attention to known principles of onion storage.

THE PLANT DISEASE REPORTER

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SUPPLEMENT 150

VIRUSES DESCRIBED PRIMARILY ON ORNAMENTAL OR MISCELLANEOUS PLANTS

July 15, 1944

The Plant Disease Reporter is issued as a service to plant pathologists throughout the United States. It contains reports, summaries, observations, and comments submitted voluntarily by qualified observers. These reports often are in the form of suggestions, queries, and opinions, frequently purely tentative, offered for consideration or discussion rather than as matters of established fact. In accepting and publishing this material the Division of Mycology and Disease Survey serves merely as an informational clearing house. It does not assume responsibility for the subject matter.

VIRUSES DESCRIBED PRIMARILY ON ORNAMENTAL OR MISCELLANEOUS PLANTS

By Philip Brierley[1], for the Sub-Committee on Ornamental Hosts, of Committee on Virus Classification and Nomenclature, American Phytopathological Society

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Introduction

The codification of published information bearing on the classification of plant viruses is one of the projects of the Committee on Virus Classification and Nomenclature of the American Phytopathological Society. This work was assigned to a number of sub-committees, each sub-committee being responsible for codifying information on the viruses described on a particular group of host plants. The sub-committee on ornamental hosts was originally headed by H. H. Thornberry and included the writer, F. A. Haasis, and F. P. McWhorter. With Thornberry in the armed service, the chairmanship passed to the writer in Novenber, 1942. Inasmuch as the other members of the sub-committee have been too pressed with other duties to take active part in the work, the writer assumes full responsibility for the organization and content of this first draft.

Only those viruses that have been described primarily on ornamental or miscellaneous plants are treated, not those described primarily on crop plants but also affecting ornamentals. The attempt is made to list all viruses in this field for which experimental transmission is claimed, but the present list is tentative and doubtless incomplete. The decision as to whether a given virus is adequately described and sufficiently distinctive to merit a name is left open. The descriptions are objective, with citations to specific literature for most statements of critical importance. The writer has taken some liberties in designating common names for the viruses and has expressed some opinions under the headings "Remarks". The form of description is adapted from Hildebrand, Berkeley, and Cation, "Handbook of virus diseases of stone fruits in North America," Mich. Agr. Exp. Sta. Misc. Publ., May 1942. The names of host plants are usually given in the form reported by investigators and do not necessarily conform to Bureau usage.

The viruses are arranged alphabetically according to the generic name of their principal host plants.

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List of Viruses Described

Abutilon-variegation
(Acer) Maple-variegation
(Aesculus) Horsechestnut-variegation
Anemone-alloiophylly
Anthurium-mosaic
Atropa-mosaic
Boltonia-streak
(Callistephus) Aster-yellows
(Callistephus) California-aster-yellows
Camellia-yellow-spot
Canna-mosaic
Cephalanthus-mosaic
Convallaria-mosaic
Dahlia-mosaic
Daphne-mosaic
Datura-mosaic
Datura-"Quercina"
Datura-virosis
Delphinium-ringspot
(Dianthus) Carnation-mosaic
Emilia-variegation
Epiphyllum-mosaic
Euonymus-variegation
Fraxinus-variegation
Gladiolus-mosaic
Holodiscus-witches'-broom
(Humulus) Hop-chlorotic-disease
(Humulus) Hop-infectious-sterility
(Humulus) Hop-mosaic
(Humulus) Hop-nettlehead
Hydrangea-virescence
Hyoscyamus-mosaic
Ilex-variegation
Iris-mosaic
Jasminum-variegation
Laburnum-variegation
(Lathyrus) Sweetpea-streak
Ligustrum-variegation
(Lilium) Lily-rosette
(Lilium) Lily-symptomless
Lonicera-variegation
Matthiola-mild-mosaic
Matthiola-severe-mosaic
Narcissus-mosaic
Narcissus-white-streak
(Nerium) Oleander-variegation
Ornithogalum-mosaic
(Paeonia) Peony-mosaic
Passiflora-fruit-woodiness
Passiflora-variegation
Pelargonium-leaf-curl
Pelargonium-mosaic
Peperomia-ringspot
Petunia-mosaic
Phlox-streak
Phytolacca-mosaic
Pittosporum-variegation
Primula-mosaic
Prunella-mosaic
(Prunus) Flowering-cherry-rough-bark
Ptelea-variegation
Rhamnus-variegation
Robinia-brooming
(Rosa) Rose-mosaic
(Rosa) Rose-streak
(Rosa) Rose-wilt
(Rumex) Dock-mosaic
(Sambucus) Elder-mosaic
(Senecio) Cineraria-streak
Sorbus-variegation
Tabebuia-witches'-broom
(Tulipa) Tulip-breaking
(Ulmus) Elm-mosaic
(Ulmus) Elm-~~phloem~~-necrosis

ABUTILON-VARIEGATION VIRUS

Names: Abutilon virus 1 (Baur) Smith 1937
Marmor abutilon Holmes 1939

Synonyms: Abutilon Panaschüre (virus) Morren 1869
Abutilon Panachirung (virus) Lindemuth 1872
Abutilon infectious Panaschierung (virus) Baur 1904
Abutilon infectious chlorosis (virus) Baur 1904
Abutilon-mosaic virus Holmes 1939

Common name: Abutilon-variegation virus

Geographic distribution: Argentine (Soriano), Belgium, England, France, Germany, Sweden (Euler et al.), United States, West Indies (Cook).

Host range: MALVACEAE—Abutilon arboreum Sweet, A. darwini Hook., A. darwini var. tesselatum Hort., A. esculentum St. Hil., A. inaequale (Link & Otto) K. Schum., A. indicum (L.) G. Don, A. insigne Planch., A. megapotamicum St. Hil. & Naud. (= vexillarium), A. regnellii Miq. (Keur 1934), A. sellovianum Regel, A. striatum Dicks., A. striatum var. thompsoni Veitch, A. theophrasti Medic. (A. avicennae Gaertn.), A. venosum Lem., A. vitifolium Presl, many Abutilon hybrids and varieties, Althaea ficifolia Cav., A. officinalis L., A. rosea (L.) Cav., Anoda hastata (Willd.) Cav. (Lindemuth 1902), Kitaibelia vitifolia Willd., Lavatera arborea L., Malva borealis Wallm. (Hertzsch 1927), M. crispa L. (Hertzsch 1927), M. mauritiana L., M. sylvestris L. (Holmes 1939), M. verticillata L., Malvastrum capense (L.) Garcke, Modiola decumbens G. Don, Palava malvaefolia Cav. (Lindemuth 1902), Sida hermaphrodita (L.) Rusby (S. napaea Cav.), S. mollis, Sidalcea candida A. Gray (Lindemuth 1907, except as noted).

Symptoms: In leaves of Abutilon striatum var. thompsoni, yellow mottling often delimited by veins; in A. sellovianum, yellowish green mottling; in Kitaibelia vitifolia, yellowish vein-clearing; in A. indicum, nearly complete yellowing, with marked dwarfing and crinkling of leaves (Hertzsch 1927). Symptoms are illustrated by Lindemuth (1907), Davis, Hertzsch, Keur. Little histological difference between green and yellow areas, no x-bodies (Davis).

Methods of transmission: By grafting or other method of transplantation (Morren 1869, Lindemuth 1872, Baur 1904, etc.). Not by sap (Baur, Hertzsch, Davis, Klebahn 1931). Not through seed (Baur). Occasionally through seed (Lindemuth 1907 (?), Keur 1934).

Properties: Klebahn's evidence (1931, 1936) indicates at least 6 to 7 days' contact of cut surfaces is required for transmission of the virus, which apparently moves through parenchyma tissues.

Remarks:
This disease was originally recognized in England in 1868 in a plant of Abutilon striatum from the West Indies. Cook (1931) describes and

illustrates variegations in wild plants of A. hirtum (Lam.) Sweet in Puerto Rico, as well as in Sida carpinifolia L. and Andenoropium gossypifolium (L.) Pohl (Jatropha gossypifolia L.). Indications of natural spread are reported.

Infected plants of Abutilon striatum have been cured by removing successive crops of variegated leaves (Baur, Davis). Green shoots arising spontaneously on variegated A. striatum do not transmit the virus (Baur, Keur), but are susceptible to infection (Keur). Althaea officinalis fails to retain the virus through winter rest; other suscepts retain it for life (Lindemuth 1907). Of 3185 seedlings from variegated Abutilon spp., 461 showed variegations, and 4 of these were shown infected with transmissible variegations (Keur).

Two distinct types of infectious chlorosis are distinguished by Hertzsch (1927): the A type in Abutilon striatum thompsoni, the B type in A. darwini tesselatum. The A type commonly includes veinal chlorosis; the B type is interveinal. Abutilon indicum, A. sellovianum, Malva borealis, M. crispa, Althaea officinalis, and Kitaibelia vitifolia proved susceptible to both, but symptoms differ; Lavatera arborea was subject to B only; Althaea taurinensis DC., Sidalcea malvaeflora A. Gray (S. atropurpurea), and Sphaeralcea umbellata G. Don were immune to both. The B type can be superimposed on A in A. striatum, symptoms of both being expressed. Keur distinguished 2 types of infectious variegations in Abutilon clones; all clones tested were susceptible to both types.

Literature:

Baur, E. Zur Aetiologie der infektiösen Panaschierung. Ber. d. Deutsch. Bot. Gesellsch. 22: 453-460. 1904.

_______ Weitere Mitteilungen über die infektiöse Chlorose der Malvaceen und über einige analoge Erscheinungen bei Ligustrum und Laburnum. Ber. d. Deutsch. Bot. Gesellsch. 24: 416-428. 1906.

_______ Über die infektiöse Chlorose der Malvaceen. Königl. Preuss. Akad. Wiss. Berlin, Sitzungsber., 1906: 11-29. 1906.

Cook, M. T. New virus diseases of plants in Porto Rico. Journ. Dept. Agric. Porto Rico 15: 193-195. 1931

Davis, E. F. Some chemical and physiological studies on the nature and transmission of "infectious chlorosis" in variegated plants. Ann. Missouri Bot. Gard. 16: 145-226. 1929.

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Hertzsch, W. Beiträge zur infektiösen Chlorose. Zeitschr. für Bot. 20: 65-85. 1927.

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Keur, J. Y. Studies of the occurrence and transmission of virus diseases in the genus Abutilon. Bull. Torrey Bot. Club 61: 53-70. 1934.

Klebahn, H. Fortsetzung der experimentellen Untersuchungen über Alloiophyllie und Viruskrankheiten. Phytopath. Zeitschr. 4: 1-36. 1931.

Klebahn, H. Versuche über das Wesen des Virus der Mosaikkrankheit des Tabaks und über einige andere Viruskrankheiten. Phytopath. Zeitschr. 9: 357-370. 1936.

Lindemuth, H. Impfversuche mit buntblättrigen Malvaceen. Verh. bot. Verein. Brandenburg 14: 32-37. 1872.

____________ Studien über die sogenannte Panaschüre und über einige begleitende Erscheinungen. Landw. Jahrb. 36: 807-862. 1907.

____________ Vorläufige Mitteilungen über weitere Untersuche an Malvaceen Arten. Gartenflora 51: 323-326. 1902.

Morren, E. Contagion de la panachure (Variegatio). Acad. Roy. Belgique. Bull. II, 28: 434-442. 1869.

Smith, K. M. A textbook of plant virus diseases. London. 1937. p. 599.

Soriano, S. Nota sobre algunas enfermedades de los vegetales producidas por 'virus' en la República Argentina. Physis (Rev. Soc. Argentina Cien. Nat.) 11 (38): 87-90. 1932. (RAM 13: 317).

(ACER) MAPLE-VARIEGATION VIRUS

Name:

Synonyms: Maple-mosaic (virus) Atanasoff

Common name: Maple-variegation virus

Geographic distribution: Bulgaria, England, France, Germany, Japan.

Host range: ACERACEAE—Acer negundo L., A. pseudoplatanus L., A. rufinerve Sieb. & Zucc.

Symptoms: Yellow variegation.

Methods of transmission: By budding (Syme) or grafting (Carrière).

Properties: Not determined.

Literature:

Atanasoff, D. Old and new virus diseases of trees and shrubs. Phytopath. Zeitschr. 8: 197-223. 1935.

Carrière, E. A. Influence du greffon sur le sujet. Revue Horticole 59: 58-59. 1887.

Hino, I. List of plants susceptible to mosaic and mosaic-like diseases. Bull. Miyazaki Coll. Agric. & For. No. 5: 97-111. 1933.

Syme, G. The influence of the bud on the stock. Gard. Chron. n.s. 8: 246. 1877

(AESCULUS) HORSECHESTNUT-VARIEGATION VIRUS

Name:

Synonyms:

Common name: Horsechestnut-variegation virus

Geographic distribution: (?) Czechoslovakia, England, Germany.

Host range: HIPPOCASTANACEAE--Aesculus hippocastanum L.

Symptoms: Yellow-leaf variegation (House 1873, Timpe 1907). Mosaic (Blattný 1938).

Methods of transmission: By budding (House 1873). By grafting (Timpe 1907).

Properties: Not determined.

Remarks:
Both House and Timpe report transmission of variegation to green stocks, symptoms appearing in the following season. Timpe reports transmission of vein-banding symptoms from scion to stock, and from stock to scion, but nevertheless interprets these effects as nutritional.

Literature:
Blattný, C. Poznámka o méně známých virových chorobách. Ochrana Rostlin 14 (55): 86-87. 1938. (RAM 17: 543).
House, H. Transfer of variegation from scion to stock. Gard. Chron. 1873: 849. 1873.
Timpe, K. Panaschierung und Transplantation. Jahrb. Hamburg. Wiss. Anstalt 24: 55-104. 1907.

ANEMONE-ALLOIOPHYLLY VIRUS

Name: Anemone virus 1 (Klebahn) Smith 1937
Galla anemones Holmes 1939

Synonyms: Anemone alloiophyllie virus Klebahn 1926

Common name: Anemone-alloiophylly virus

Geographic distribution: Germany.

Host range: RANUNCULACEAE--Anemone nemorosa L., A. ranunculoides L., A. trifolia L. (Klebahn 1928)

Symptoms: Initial symptoms marked hypertrophy of young buds, with the general aspect of a gall, the rhizome remaining unaffected (Klebahn 1926). General hypertrophy of aboveground parts. Leaves pale, with broadened lobes overlapping each other, wrinkled especially at

the margins with upward rolling of the margins common. Flowers rarely produced, deformed, the sepals and carpels hypertrophied, stamens few, pollen lacking (Klebahn 1897), apparently always sterile (Klebahn 1928).

Methods of transmission: By sap (Klebahn 1926). By sap after filtration (Klebahn 1931, 1936). By soil (Klebahn 1926, 1936). No vector known. Symptoms in the season following inoculation.

Properties: Passes collodion filter (Klebahn 1928, 1931, 1936). Precipitated by alcohol from glycerin suspension (Klebahn 1931). Dried leaves are infectious (Klebahn 1936).

Remarks:

The disease occurs sporadically in the wild Anemone nemorosa, chiefly in North Germany. Infected plants are often larger than normal, conspicuous for their pale green color, lack of bloom, or late and long-persisting flowers. Infected and normal shoots may arise from the same rhizome. Diseased rhizomes usually, but not always, develop the disease when grown in a second season.

Literature:

Holmes, F. O. Handbook of phytopathogenic viruses. Minneapolis 1939. p. 108

Klebahn, H. Ueber eine krankhafte Veränderung der Anemone nemorosa L. und über einen in den Drüsenhaaren derselben lebenden Pilz. Bericht. d. Deutsch. Bot. Gesellsch. 15: 527-536. 1897.

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Ulbrich, E. Ein neuer Fall von 'Alloiophyllie' bei Anemone nemorosa L. Verh. bot. Ver. Brandenburg 77: 86-89. 1937.

ANTHURIUM-MOSAIC VIRUS

Name:

Synonyms:

Common name: Anthurium-mosaic virus

Geographic distribution: Belgium

Host range: ARACEAE—*Anthurium andraeanum* Lind., *A. scherzerianum* Schott, *Monstera deliciosa* Liebm., *Philodendron corsinianum* Makoy, *Zantedeschia aethiopica* (L.) Spreng. (*Z. africana* Kunth). SOLANACEAE—*Datura stramonium* L.

Symptoms: In leaves of *Anthurium scherzerianum*, systemic grayish-white necrotic spots or lines, curling, malformation; also pale yellow chlorotic lines or spotting; in leaves of *Monstera deliciosa*, *Philodendron corsinianum*, and *Zantedeschia aethiopica*, very fine pale undulating furrows; in *Datura stramonium* scattered angular yellow spots (after 26 days).

Methods of transmission: By sap.

Properties: Not determined.

Remarks:

Experimental infection in *Anthurium scherzerianum*, *Monstera*, *Philodendron*, *Zantedeschia*, and *Datura*, not in *Arum italicum*, *Nicotiana tabacum*, or *Physalis alkekengi*.

Literature:

Verplancke, G. Une maladie à virus filtrant des *Anthurium*. Comptes rendus Soc. de Biol. 103 (7): 524-526. 1930.

ATROPA-MOSAIC VIRUS

Name:

Synonyms: Belladonna virus K. M. Smith 1943

Common name: Atropa-mosaic virus

Geographic distribution: England.

Host range: LEGUMINOSAE—*Phaseolus vulgaris* L. SOLANACEAE—*Atropa belladonna* L., *Datura stramonium* L., *Hyoscyamus niger* L., *Nicotiana glutinosa* L., *N. tabacum* L., *Solanum nigrum* L.

Symptoms; In *Atropa belladonna*, patchy leaf mottling with necrotic spotting under greenhouse conditions; severe leaf and stem necrosis

out of doors. In Nicotiana glutinosa and N. tabacum, primary lesions followed by systemic necrosis. In Phaseolus vulgaris var. Canadian Wonder, primary lesions only.

Methods of transmission: By sap.

Properties: Thermal inactivation point 75-80°C. Infectious at dilution 1:1000, not at 1:10,000. Withstands aging in expressed sap 6 days, not 11 days.

Remarks:
Not transmitted by Myzus persicae Sulz. nor by Thrips tabaci Lind.; the virus is thought not to be insect-borne.

Literature:

Smith, K. M. A virus disease of Atropa belladonna. Parasitology 35 (3): 159-160. illus. 1943

BOLTONIA-STREAK VIRUS

Name:

Synonyms:

Common name: Boltonia-streak virus.

Geographic distribution: Canada (New Brunswick).

Host range: COMPOSITAE--Boltonia sp.

Symptoms: Clearing of veins, followed by vein necrosis and collapse of leaves, streaking of leaves and stems.

Methods of transmission: By grafting. Not by sap.

Properties: Not determined.

Literature:

D. J. McLeod. In Conners, I. J. Twenty-first Ann. Rept. Canadian Plant Disease Survey, 1941. xviii + 102 pp., 1942. p. 88.

(CALLISTEPHUS) ASTER-YELLOWS VIRUS

Names: Callistephus virus 1 (Kunkel) Smith 1937
Chlorogenus callistephi var. vulgaris Holmes 1939

Synonyms: Lettuce Rio Grande disease virus R. E. Smith 1902
Aster yellows virus Kunkel 1924
Lettuce white-heart virus Kunkel 1926
Lettuce rabbit-ear virus Kunkel 1926
Erigeron-yellows virus McClintock 1931

New York aster-yellows virus Kunkel 1932
New York aster-yellows virus Severin 1934a
Gelbsucht der Sommerastern virus Richter 1936
Salsify yellows virus Holmes 1939
Lettuce and endive yellows virus Linn 1940
Potato purple-top wilt virus Younkin 1943

Common name: Aster-yellows virus.

Geographic distribution: United States (replaced by California aster yellows in Pacific and Mountain States (Severin 1934a)), Canada (Conners 1942), Bermuda (Ogilvie 1927), Hungary (Severin 1934b), Germany (Richter 1936), Japan (Fukushi 1930).

Host range:

ACANTHACEAE—Thunbergia alata Bojer.

AIZOACEAE—Tetragonia expansa Murr.

AMARANTHACEAE—Amaranthus auroro, A. caudatus L.

APOCYNACEAE—Vinca rosea L.

ASCLEPIADACEAE—Asclepias nivea L.

BEGONIACEAE—Begonia semperflorens Link & Otto

BORAGINACEAE—Anchusa barrelieri Vitm., A. capensis Thunb., Myosotis scorpioides L.

CAMPANULACEAE—Lobelia erinus L.

CARYOPHYLLACEAE—Dianthus alpinus L., Gypsophila paniculata L., Herniaria glabra L., Lychnis coronaria (L.) Desr., L. viscaria L., Polycarpon tetraphyllum L., Silene pendula L., Tunica saxifraga (L.) Scop., Vaccaria parviflora Moench (V. segetalis (Neck.) Garcke).

CHENOPODIACEAE—Monolepis nuttalliana (Schult.) Greene (M. chenopodioides (Nutt.) Moq.), Spinacia oleracea L.

CISTACEAE—Helianthemum chamaecistus Mill.

COMPOSITAE—Acroclinum roseum Hook., Agoseris glauca (Nutt.) D. Dietr. (Troximon glaucum Nutt.) (Palm 1933), Ambrosia artemisiifolia L., A. trifida L., Ammobium alatum R.Br., Anthemis tinctoria L., Arctotis grandis Thunb., Bellis perennis L., Brachycome iberidifolia Benth., Cacalia hastata L., Calendula officinalis L., Callistephus chinensis (L.) Nees, Carthamus tinctorius L., Centaurea imperialis Hort., C. margaritae Hort., Charieis heterophylla Cass., Chrysanthemum cinerariaefolium (Trev.) Vis., C. coronarium L., C. frutescens L., C. leucanthemum L., C. leucanthemum maximum, C. maximum Ramond, C. parthenium (L.) Bernh. (Feverfew), C. sp. (Little Gem), C. sp. (Pyrethrum sp.), Cichorium endivia L. (Linn 1940), Cineraria hybrida Hort., Cirsium oleraceum (L.) Scop., Cladanthus arabicus (L.) Cass., Coreopsis lanceolata L., C. stillmanii (A. Gray) Blake (Leptosyne stillmani Gray), Coreopsis sp. (Calliopsis), Cosmos bipinnatus Cav., Cousinia hystrix C. A. Mey., Dimorphotheca aurantiaca DC., Echinops dahuricus Fisch., Emilia flammea Cass., Erigeron annuus (L.) Pers., E. canadensis L., E. glabellus Nutt., E. linifolius Willd., E. speciosus (Lindl.) DC., Ethulia conyzoides L., Eupatorium rugosum Houtt. (E. urticaefolium Reich.), E. perfoliatum L., Felicia aethiopica (Burm.) O. Hoffm., F. amelloides (L.) Voss., Filago germanica L., Flaveria trinervia (Spreng.) C. Mohr (F. repanda Lag.), Gaillardia aristata Pursh, Galinsoga parviflora Cav.,

Grindelia squarrosa (Pursh) Dun., Hedypnois cretica (L.) Willd., Helenium autumnale L., H. bigelovii Gray, H. hoopesii Gray, H. nudiflorum Nutt., Helichrysum arenarium (L.) DC., Heliopsis laevis (L.) Pers., Helipterum manglesii F. Muell., Hieracium alpinum L., H. floribundum Wimm. & Grab. (Conners 1942), Koelpinia linearis Pall., Lactuca sativa L., Lagascaea mollis Cav., Leontodon autumnalis L., Leontopodium alpinum Cass., Lindheimeria texana Gray & Engelm., Lonas inodora (L.) Gaertn., Matricaria alba, Mulgedium alpinum (L.) Less., Parthenium integrifolium L., Petasites albus (L.) Gaertn., Rudbeckia hirta L., Sanvitalia procumbens Lam., Schkuria abrotanoides Roth, Scolymus hispanicus L., Sonchus arvensis L., S. oleraceus L., Spilanthes acmella (L.) Murr., Tagetes erecta L., Taraxacum officinale Weber, Thelesperma burridgeanum (Regel) Blake (T. hybridum Voss; Cosmidium), Tolpis barbata (L.) Gaertn., Tragopogon floccosus W. & K., T. porrifolius L., Tridax trilobata (Cav.) Hemsl., Ursinia arthemoides (L.) Benth. & Hook., Zacyntha verrucosa Gaertn., Zinnia multiflora L.

CRUCIFERAE--Alyssum maritimum var. procumbens Hort. (A. compactum procumbens), Cheiranthus allionii Hort., Malcomia maritima (L.) R.Br., Rorippa hispida (Desv.) Britton (Radicula palustris var. hispida (Desv.) Robinson), R. sylvestris (L.) Bess. (Radicula sylvestris (L.) Druce).

DATISCACEAE--Datisca cannabina L.

DIPSACACEAE--Scabiosa atropurpurea L.

GESNERIACEAE--Didymocarpus horsfieldii Schinz., Gloxinia sp.

HYDROPHYLLACEAE--Nemophila sp., Phacelia congesta Hook., P. minor (Harv.) Thell. (P. campanularia A. Gray, P. whitlavia A. Gray), P. viscida Torr.

LABIATAE--Dracocephalum ruyschianum L., Lavandula sp. (Lavender), Physostegia virginiana (L.) Benth., Satureia hortensis L.

LILIACEAE--Allium cepa L. (Brierley & Smith 1944).

LIMNANTHACEAE--Limnanthes douglasii R.Br.

LOASACEAE--Blumenbachia hieronymi Urb., Cajophora lateritia (Hook.) Kl.

MARTYNIACEAE--Martynia sp.

MORACEAE--Humulus japonicus Sieb. & Zucc.

NYCTAGINACEAE--Abronia umbellata Lam.

ONAGRACEAE--Clarkia elegans Dougl.

PAPAVERACEAE--Eschscholzia californica Cham., Papaver nudicaule L.

PLANTAGINACEAE--Plantago alpina L., P. fuscescens Jord., P. major L., P. psyllium L.

PLUMBAGINACEAE--Armeria alpina Willd., Limonium suworowi (Regel) Kuntze

POLEMONIACEAE--Gilia densiflora Benth., G. tricolor Benth., Phlox drummondii Hook., P. paniculata L., Polemonium caeruleum L.

POLYGONACEAE--Fagopyrum esculentum Moench

PORTULACACEAE--Calandrinia grandiflora Lindl., Portulaca sp.

PRIMULACEAE--Anagallis linifolia L., Primula elatior Hill.

RANUNCULACEAE--Adonis aestivalis L.

RESEDACEAE--Reseda odorata L.

ROSACEAE--Potentilla monspeliensis L.

SCROPHULARIACEAE--Alonsoa warscewiczi Regel, Calceolaria sp., Collinsia bicolor Benth., Linaria cymbalaria (L.) Mill., L. maroccana Hook., Maurandia lophospermum Bailey, M. scandens (Cav.) Pers.,

Mimulus luteus L., Nemesia sp., Verbascum hybridum Hort., Veronica peregrina L.

SOLANACEAE--Browallia demissa L., Hyoscyamus niger L., Lycopersicon esculentum Mill. (Solanum lycopersicum L.), Nicotiana rustica L., Petunia hybrida Vilm., Salpiglossis sp., Schizanthus sp., Solanum tuberosum L. (Younkin 1943).

UMBELLIFERAE--Ammi majus L., Anethum graveolens L., Daucus carota L., Didiscus caeruleus DC., D. pusillus F. & M., Levisticum paludapifolium (Lam.) Aschers., Pastinaca sativa L., Pimpinella anisum L.

VALERIANACEAE--Centranthus calcitrapa (L.) Dufr.

(Kunkel 1926, 1931 except as noted).

Symptoms: Erect habit and abnormal stimulation of lateral branching. In some hosts general chlorosis without mottling. Clearing of veins in young leaves, virescence of flowers and sterility. Symptoms after about 10 days.

In China aster, diseased ovaries are elongated and thickened, ovules elongated and shriveled, and pappus hairs are modified to bract-like scales. In marguerite (Chrysanthemum frutescens) the pistils elongate and bear secondary flower buds (Smith 1902). In Agoseris glauca the pollen is normal in yellowed plants but the ovules are abnormal. The development of sporogenous cells is delayed or lacking, the funiculus elongated and flattened, the integument is deficient or undifferentiated, and anatropous growth is retarded. The female gametophyte degenerates at the 2-nucleate stage.(Palm 1933.)

Methods of transmission: By grafting and budding (Kunkel 1926). By dodder (Johnson 1941). By Macrosteles divisus (Uhl.) (formerly known as Cicadula sexnotata (Fall.), C. divisa (Uhl.)) (Kunkel 1924). Not by sap from aster to aster (Kunkel 1926, 1931, Rawlins and Tompkins 1936) but transmissible by juice from viruliferous to non-viruliferous hoppers (Black 1940). Not through seeds (Kunkel 1926, McClintock 1931). Not through eggs of the vector (Kunkel 1926).

Properties: Active in extracted juice of viruliferous Macrosteles divisus at dilutions up to 1:1000. Largely destroyed by freezing for 20 minutes at -10°C (Black 1941). Withstands aging 24 but not 48 hours at 0°C, 2 but not 3 hours at 25°C, 10 minutes at 35°C. Passes Berkefeld N and V filters that retain Serratia marcescens. Precipitated by centrifuging 1 minute at 500 r.p.m. (Black 1943). Inactivated in living M. divisus at 32°C in 12 days, or at 42°C in 1 day (Kunkel 1937, 1941); in living Vinca rosea L. at 42°C in 14 days or at 38°C in 14 days (Kunkel 1941).

Remarks:

Macrosteles divisus acquires the virus in 24 hours, not in 2 hours, of feeding on the source plant (Kunkel 1926). Hoppers become infective after an incubation period of 10 days or more (Kunkel 1926). Many individuals of M. divisus retain the virus for life (some over 100 days); some appear to lose it after a short time (Kunkel 1926).

No visible evidence of the virus is found in the vector Macrosteles divisus (Kunkel 1926, Dobroscky 1929). By mechanical inoculation from

viruliferous to non-viruliferous M. divisus Black (1941) has shown that the virus is present in the vector, that it undergoes an incubation period of 11 to 45 days in inoculated hoppers, and that it multiplies at least 100-fold in the vector during this incubation period. Inoculated hoppers usually retain the virus for life. The virus reaches a high concentration in inoculated M. divisus 6 days before the hoppers are able to transmit it to asters (Black 1941).

California-aster-yellows virus is distinguished from the type strain by additional host and vector species (Kunkel 1932, Severin 1934a). A heat-attenuated strain (Chlorogenus callistephi var. attenuatus Holmes) experimentally produced by Kunkel (1937) is distinguished from the type strain by milder symptom expression in asters. Potato purple-top wilt virus differs from the type strain of aster-yellows virus in symptom expression in Nicotiana rustica (Younkin 1943).

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____________ Transmission of California aster and celery yellows virus by three species of leafhoppers. Hilgardia 8: 339-361. 1934 (b)
Smith, K. M. A textbook of plant virus diseases. London 1937. p. 214-226.
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(CALLISTEPHUS) CALIFORNIA-ASTER-YELLOWS VIRUS

Names: Callistephus virus 1A (Severin) Smith 1937
Chlorogenus callistephis var. californicus Holmes 1939

Synonyms: Celery yellows virus Severin 1929
Delphinium witches' broom virus (?) Hungerford 1933
California aster yellows virus Severin 1934a
Delphinium stunt virus (in part) Burnett 1934
Delphinium aster yellows virus Severin and Oliver 1939

Common name: California-aster-yellows virus

Geographic distribution: United States--California, Colorado, Oregon, Utah, Washington, Wyoming (Severin 1934, 1942a)

Host range: CHENOPODIACEAE--Spinacia oleracea L. COMPOSITAE--Callistephus chinensis (L.) Nees, Chrysanthemum segetum L., Helichrysum bracteatum Andr., Lactuca sativa L., Sonchus asper (L.) Hill (Severin 1942a), Tagetes erecta L., T. patula L. Tragopogon porrifolius L., Zinnia elegans Jacq., Z. haageana Regel. CRUCIFERAE--Brassica alba (L.) Boiss. LILIACEAE--Allium cepa L. (KenKnight 1943). MALVACEAE--Malva parviflora L. (Severin 1942a). ONAGRACEAE--Godetia grandiflora Lindl. PAPAVERACEAE--Eschscholzia californica Cham. PLANTAGINACEAE--Plantago major L. POLYGONACEAE--Fagopyrum esculentum Moench. RANUNCULACEAE--Delphinium ajacis L. (Severin 1942a,c), D. cultorum Voss (?) (perennial delphinium, Severin

1942a), Ranunculus asiaticus L. SOLANACEAE--Nicotiana rustica L., Solanum tuberosum L. (Severin & Haasis 1943, Severin 1940). UMBELLIFERAE--Anethum graveolens L., Apium graveolens L. and vars. dulce and rapaceum, Daucus carota L. var. sativa, Pastinaca sativa L., Petroselinum crispum (Mill.) Nym. (P. hortense Hoffm.) and vars. crispum and radicosum.

Apium graveolens, Zinnia elegans, Solanum tuberosum, and Brassica alba, as well as species susceptible to the virus of typical aster yellows so far as tested (Holmes 1939). It has been reported subsequently (Younkin 1943) that S. tuberosum is susceptible to typical aster yellows as well.

Symptoms: In celery, the outer petioles first upright and somewhat elongated, the inner petioles short, chlorotic, twisted, brittle, and often cracked. General yellowing (Severin 1929). In zinnia, chlorosis, stunting, abnormal flowers (Severin 1929). In potato, purple, sessile aerial tubers, with purple, dwarfed leaves developing from these tubers (Severin 1940). In delphinium, dwarfing, yellowing, proliferation of laterals, virescence of flowers, phyllody of carpels and stamens (Severin 1942a). In China aster and most other hosts, symptoms as for the type strain.

Methods of transmission: By Macrosteles divisus (Uhl.) (formerly called Cicadula sexnotata (Fall.) and C. divisa Uhl.) (Severin 1934a, 1942a). By both short- and long-winged races of this leafhopper (Severin 1940, 1942a). By Thamnotettix geminatus Van D. and T. montanus Van D. (Severin 1934b). Not by sap (Severin 1929, 1942a). Not through seed (Burnett 1934). Symptoms after 11 to 27 days in China aster, after 18 to 79 days in celery (Severin 1929), after 15 to 106 days in delphinium (Severin 1942a).

Properties: The virus requires an incubation period of 17 to 26 days in the vector Macrosteles divisus (Kunkel 1932). It is not carried in the eggs of the vectors Thamnotettix geminatus and T. montanus (Severin 1934b). It is rarely transmitted by M. divisus from solutions containing crushed infective individuals of this species (Severin 1934a).

Remarks:

Thamnotettix montanus and T. geminatus transmit the virus with low efficiency to aster, and with somewhat higher efficiency to celery (Severin 1934b, 1942a). T. montanus failed to transmit the type strain from New York and Wisconsin collections of aster to aster or celery (Severin 1943a).

Perennial delphiniums are unfavorable food plants for Macrosteles divisus, but favored breeding plants for Thamnotettix geminatus and T. montanus. The two last named are therefore the most important vectors of this virus in delphiniums. The geographic distribution of California aster yellows corresponds well with that of T. geminatus and T. montanus (Severin 1942a).

Delphinium-stunt virus (Burnett 1934) is not synonymous with aster-yellows virus, but the greening and malformation of the inflorescence and dwarfing that Burnett described but failed to transmit by sap are

considered symptoms of California aster yellows (Severin 1942a,b), while Burnett's sap-transmitted virus may have been celery-calico virus which is often associated with California-aster-yellows virus in delphiniums in nature (Severin 1942b).

Aster-yellows virus in samples of delphinium, carrot, and celery from Idaho did not prove identical with the California-aster-yellows virus (Severin 1934a, 1942a). Consequently Hungerford's (1933) delphinium witches'broom, and KenKnight's (1943) onion-yellows are only tentatively attributed to this strain.

Literature:

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Severin, H. H. P. Yellows disease of celery, lettuce, and other plants, transmitted by <u>Cicadula sexnotata</u> (Fall.). Hilgardia 3: 543-583. 1929.

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_______________ Transmission of California aster and celery yellows by three species of leafhoppers. Hilgardia 8: 339-361. 1934 (b).

_______________ Potato naturally affected with California aster yellows. Phytopath. 30: 1049-1051. 1940.

_______________ Infection of perennial delphiniums by California aster-yellows virus. Hilgardia 14: 411-440. 1942 (a).

_______________ Celery calico on perennial delphiniums and certain other host plants. Hilgardia 14: 443-464. 1942 (b).

_______________ Viroses of annual larkspurs. Hilgardia 14: 585-594. 1942 (c).

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CAMELLIA-YELLOW-SPOT VIRUS

Name:

Synonyms:

Common name: Camellia-yellow-spot virus. Milbrath & McWhorter 1940.

Geographic distribution: Oregon.

Host range: TERNSTROEMIACEAE--*Camellia* sp.

Symptoms: In leaves, yellowing, mottling, epidermal roughening or corkiness, occasionally necrosis.

Methods of transmission: By grafting.

Properties: Not determined.

Literature:

Milbrath, J. A., and McWhorter, F. P. Camellia yellow spot - a virus disease. Phytopath. 30: 788. 1940. (Abst.).

CANNA-MOSAIC VIRUS

Name:

Synonyms: Canna indica mosaic virus Ocfemia & Macaspac 1941.

Common name: Canna-mosaic virus.

Geographic distribution: Japan (Fukushi 1932), Philippines (Ocfemia 1937).

Host range: CANNACEAE--*Canna edulis* Ker, *C. indica* L., *Canna* spp. (ornamental varieties). MUSACEAE--*Musa textilis* Née.

Symptoms: In *Canna indica*, irregular pale yellow streaks parallel with lateral veins of leaves, later often rusty brown, with more or less wrinkling, curling, and premature drying. Yellowish bands on stems, sepals, and petals. Mottling of fruits. Initial symptoms after 2 weeks. In ornamental cannas, rusty brown streaks in leaves, and orange streaks in petals. In *Musa textilis*, greenish-yellow, later yellowish-orange streaks in leaves, parallel with the lateral veins (Ocfemia and Macaspac 1941.)

Methods of transmission: By sap with difficulty (?) (one infection). By *Aphis gossypii* Glover, and *A. maidis* Fitch. Not by *A. laburni* Kalt., *Pentalonia nigronervosa* Coq., or *Rhopalosiphum nymphaeae* L. Not through seed of *Canna indica* (Ocfemia & Macaspac 1941.)

Properties: Not determined.

Remarks:

Canna-mosaic virus appears distinct from abacá-mosaic virus (=cucumber-mosaic virus, Celino 1940) although both produce somewhat similar symptoms in *Canna indica* and *Musa textilis*. Canna-mosaic virus is transmissible to *C. edulis* and ornamental canna varieties by *Aphis gossypii* (Ocfemia & Macaspac 1941), but abacá-mosaic virus is not transmitted to these plants by its vector *Rhopalosiphum nymphaeae* (Celino 1940). *R. nymphaeae* failed to transmit canna-mosaic virus (Ocfemia & Macaspac 1941).

Canna-mosaic virus was not transmitted to cucumber by *Aphis gossypii* (Ocfemia & Macaspac 1941.)

Aphis gossypii transmits canna-mosaic virus in the non-persistent manner, acquiring the virus in 5 minutes' feeding on a source plant, and becoming noninfective after feeding on one healthy plant or after 1 hour in a test tube without food (Ocfemia & Macaspac 1941).

Literature:

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____________, and Macaspac, I. S. Experimental transmission of the mosaic of *Canna indica*. Philipp. Agric. 30: 357-370. 1941.

CEPHALANTHUS-MOSAIC VIRUS

Name:

Synonyms:

Common name: Cephalanthus-mosaic virus.

Geographic distribution: United States (Missouri).

Host range: RUBIACEAE—*Cephalanthus occidentalis* L.

Symptoms: Small pale spots in young leaves, enlarging and coalescing to form conspicuous large irregular yellow patches in older leaves; pale green spots on petioles and young twigs also. Little change

in anatomy or cytology of diseased leaves until late stages, when chloroplasts degenerate and large starch grains appear.

Methods of transmission: By sap, (Symptoms after 7 to 16 days).

Properties: The virus is killed at 100°C, not at 60°C (time not specified). Infectious in dried herbarium material 1 to 2 weeks old. Sap diffused through an unspecified membrane was infectious.

Remarks:
Extracts from diseased leaves, petioles, shoots, and roots were all infectious. Inoculations from root to root, and thence to leaves, succeeded; this suggested to Uphof that natural spread is through roots. Inoculations of other plant species associated with Cephalanthus in the wild were negative.

Literature:
Uphof, J. C. T. Eine neue Krankheit von Cephalanthus occidentalis. Zeitschr. Pflanzenkr. 31: 100-108. 1921.

CONVALLARIA-MOSAIC VIRUS

Name:

Synonyms:

Common name: Convallaria-mosaic virus. Blattný 1929.

Geographic distribution: Czechoslovakia.

Host range: LILIACEAE—Convallaria majalis L.

Symptoms: Mosaic mottling.

Methods of transmission: By sap inoculation of underground parts. By cutting with a knife contaminated with the virus. No vector is established.

Properties: Not determined.

Literature:
Blattný, C. Mosaika konvalinky (Convallaria majalis L.). Ochrana Rostlin 9: 19-21. 1929 (RAM 8: 589. 1929).

DAHLIA-MOSAIC VIRUS

Name: Dahlia virus 1 (Brandenburg) Smith 1937
Marmor dahliae Holmes 1939

Synonyms: Dahlia mosaic and yellows (virus) Howe 1922
Dahlia stunt or dwarf (virus) Howe 1923
Dahlia leaf-curl and rosette virus Martin 1929

Common name: Dahlia-mosaic virus.

Geographic distribution: Widespread. Belgium, England, Germany, Holland, United States, Canada, Argentine, Brazil, Australia.

Host range: COMPOSITAE—Dahlia imperialis Roezl, D. maxonii Safford, D. variabilis Desf.

Symptoms: In leaves, chlorotic vein-banding. Rosetting in some varieties.

Methods of transmission: By grafting (Brandenburg 1928). Not by sap. By Myzus persicae Sulz. (Brierley 1933).

Properties: Not determined.

Remarks:

Dahlia mosaic is typically a vein-mosaic, with narrow to broad yellowish bands associated with the midribs or branch veins. Dahlia ringspot, yellow-ringspot, and oakleaf (Brierley 1933), characterized by chlorotic or necrotic rings or furrows, are not treated here because of the strong probability that they represent forms of tomato spotted-wilt, caused by Lycopersicum Virus 3 (Brittlebank) Smith 1937; Lethum australiense Holmes 1939 (Smith 1937, McWhorter 1941, and unpublished evidence from various sources).

Streak, characterized by black necrotic streaks in stems, petioles, and flower stalks, and by brown necrotic lesions in storage roots, is described as a separate virus disease by Campbell (1933, 1934), and is reported by Schneiders (1937), but no evidence of experimental transmission is reported.

Literature:

Berkeley, G. H. Dahlia mosaic and its control. Canad. Hort. (Floral ed.) 61: 146-147. 1938.

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Campbell, A. H. A serious disease of dahlias. The Dahlia Year Book 1933, pp. 13-15. 1933.

____________ Virus diseases of dahlias. The Dahlia Year Book 1934, pp. 14-23. 1934.

Goldstein, B. The x-bodies in the cells of dahlia plants affected with mosaic disease and dwarf. Bull. Torrey Bot. Club 54: 285-293. 1927.

Herbert, D. Plant viruses in Queensland I, Pap. Dep. Biol. Univ. Queensland 1, 11, 4pp. 1939.

Holmes, F. O. Handbook of phytopathogenic viruses. Minneapolis 1939. p. 85-86.

Howe, M. A. The leafhopper as an enemy of the dahlia. Bull. Amer. Dahlia Soc. Ser. 3 (22): 18; (23): 18, 26. 1922

Howe, M. A. Dahlias and their culture. Journ. New York Bot. Gard. 24: 169-187. 1923
Marchal, É. Observations et recherches effectués à la Station de Phytopathologie de l'Etat pendant l'année 1933. Bull. Inst. Agron. et des Stat. de Recherches de Gembloux 3: 97-106. 1934. (RAM 13: 492).
Marchionatto, J. B. Las enfermedades de las Dalias. Bol. Agríc. Mendoza 8: 337-341. 1940.
McWhorter, F. P. Certain ornamentals may carry virus diseases to truck crops. Oregon St. Hort. Soc. Ann. Rept. 1941: 47-50. 1941.
Müller, A. S. Brazil: preliminary list of diseases of ornamental plants in the State of Minas Geraes. Int. Bul. Plant Protect. 9 (5): 104-105. 1935 (RAM 14: 634).
Schneiders, E. Über Abbau und Viruskrankheiten der Kulturpflanzen unter besonderer Berücksichtigung der Viruskrankheiten an Dahlien. Gartenflora 86: 199-202. 1937.
Smith, K. M. A textbook of plant virus diseases. London 1937. pp. 208-212.

DAPHNE-MOSAIC VIRUS

Name:

Synonyms:

Common name: Daphne-mosaic virus

Geographic distribution: New Zealand.

Host range: THYMELAEACEAE—*Daphne odora* Thunb.

Symptoms: Pale yellowish spotting, typically close-spaced and forming an even mosaic pattern, also large irregular yellowish patches with a tendency to follow the veins, and occasional distortion of the leaf lamina.

Methods of transmission: By sap (with difficulty). By grafting.

Properties: Not determined.

Remarks:
Symptomless shoots appear on diseased plants; the virus is usually not present in such shoots.

Literature:

Chamberlain, E. E., and Matthews, R. E. F. A virus disease of cultivated Daphne. New Zealand Jour. Science & Techn. 23:.254A-256A. 1941.

DATURA-MOSAIC VIRUS

Name:

Synonyms:

Common name: Datura-mosaic virus

Geographic distribution: India

Host range: SOLANACEAE—*Datura fastuosa* L., *Nicotiana glutinosa* L., *Petunia hybrida* Vilm.

Symptoms: In *Datura fastuosa*, green mottling in leaves; in *Nicotiana glutinosa*, local lesions; in *Petunia hybrida*, transitory leaf mottling.

Methods of transmission: By sap.

Properties: Not determined.

Literature:

Rep. Imp. Counc. Agric. Res., New Delhi, 1940-41, p. 36, 1942. (RAM 21: 342).

Rep. Imp. Counc. Agric. Res. Delhi, 1941-42, pp. 3-39, 1943. (RAM 22:381).

DATURA-"QUERCINA" VIRUS

Name:

Synonyms:

Common name: Datura-"Quercina" virus

Geographic distribution: England, France, United States.

Host range: SOLANACEAE--*Datura meteloides* DC., *D. stramonium* L., *Solanum pseudocapsicum* L.

Symptoms: In *Datura stramonium*, indentations in leaf margins, slitting of the corolla, shriveling of stamens with little or no functional pollen, partial or complete suppression of spines on the capsules, general reduction in vigor. In purple flowered varieties the stems and corollas are deeper colored than normal.

Methods of transmission: Not by sap. By grafting. By seeds to 79 percent of the offspring of "Quercina" female parents. By pollen.

Properties: Not determined.

Remarks:

Potato, petunia, pepper are not susceptible. The Z disease described by Blakeslee (1921) is now attributed to a strain of Tobacco-etch virus (Nicotiana virus 7 Smith 1937, Marmor erodens Holmes 1939) by Chester (1937).

Literature:

Blakeslee, A. F. A graft-infectious disease of Datura resembling a vegetative mutation. Journ. Genetics 11: 17-36. 1921.

Chester, K. S. Serological studies of plant viruses. Phytopath. 27: 903-912. 1937.

DATURA-VIROSIS VIRUS

Name: Datura virus 1 Smith and d'Oliveira 1937

Synonyms:

Common name: Datura-virosis virus

Geographic distribution: England

Host range: LEGUMINOSAE—Phaseolus vulgaris L., Vigna sinensis (Torner) Savi. SOLANACEAE—Datura stramonium L., Nicotiana tabacum L., N. glutinosa L., Lycopersicon esculentum Mill.

Symptoms: In Datura stramonium, in rubbed leaves, yellow flecks becoming necrotic and enlarging with age; also systemic yellow flecking. Similar effects in other hosts.

Methods of transmission: By sap. Transmission by Myzus persicae Sulz. suspected but not demonstrated.

Properties: Thermal death point 50-55°C. Dilution end point between 1:5000 and 1:10,000. Infectious in expressed sap after 9 days, not after 12 days, at room temperatures.

Literature:

Smith, K. M. A textbook of plant virus diseases. London 1937. p. 332-335.

DELPHINIUM-RINGSPOT VIRUS

Name:

Synonyms: Delphinium ringspot virus Severin and Dickson 1942

Common name: Delphinium-ringspot virus

Geographic distribution: United States (California).

Host range: CHENOPODIACEAE—*Beta vulgaris* L. CUCURBITACEAE—*Cucumis sativus* L. MALVACEAE—*Gossypium hirsutum* L. RANUNCULACEAE—*Delphinium* sp. (perennial delphinium), *Ranunculus asiaticus* L. SOLANACEAE—*Datura stramonium* L., *Nicotiana alata* Link & Otto var. *grandiflora* Comes, *N. glutinosa* L., *N. rustica* L. var. *humilis* Schrank, *N. tabacum* L., *Petunia hybrida* Hort. The virus appears to be restricted to perennial delphinium in nature (Severin & Dickson 1942).

Symptoms: "On young leaves of delphinium faint chlorotic rings enclosing green or yellow centers; on mature leaves, irregular chlorotic rings encircling green areas, yellow bands, and irregular chlorotic areas" (Severin & Dickson 1942).

Methods of transmission: By sap. No vector is known. Symptoms after 32 to 42 days in delphinium.

Properties: Thermal inactivation point 60-65°C. Dilution tolerance 1:1000. Tolerates aging at room temperature 4 days, not 5 days.

Remarks:

Severin and Dickson (1942) consider delphinium-ringspot virus distinct from 8 other viruses that Severin (1942,a,b,c) has studied in this species, namely the viruses of California aster yellows, celery calico, tomato spotted wilt, cucumber mosaic, western cucumber mosaic, tobacco ringspot, tobacco mosaic, and curly top. Delphinium-ringspot virus agrees most closely with cucumber-mosaic virus, of which Valleau's (1932) delphinium virus is now considered to be a strain (Chester 1937); but delphinium-ringspot virus failed to infect a number of species that are susceptible to cucumber-mosaic virus, including *Spinacia oleracea*, *Vigna sinensis*, *Apium graveolens* var. *dulce*, *Lycopersicon esculentum*, and *Capsicum frutescens*, and was not transmitted by any of the insects tested, including *Aphis gossypii* Glover and *Myzus persicae* (Sulz.) (Severin & Dickson 1942).

Literature:

Chester, K. S. Serological studies of plant viruses. Phytopath. 27: 903-912. 1937.

Severin, H. H. P. Infection of perennial delphiniums by California aster-yellows virus. Hilgardia 14: 411-440. 1942 (a).

__________ Celery calico on perennial delphiniums and certain other host plants. Hilgardia 14: 441-464. 1942 (b).

__________ The susceptibility of perennial delphiniums to six viruses. Hilgardia 14: 549-561. 1942 (c).

__________, and Dickson, R. C. Perennial delphinium ringspot. Hilgardia 14: 465-490. 1942.

Valleau, W. D. A virus disease of delphinium and tobacco. Kentucky Agr. Exp. Sta. Bull. 327: 81-88. 1932.

(DIANTHUS) CARNATION-MOSAIC VIRUS

Name:

Synonyms: Carnation-yellows (virus) Jones 1940
Carnation mosaic virus Creager 1943

Common name: Carnation-mosaic virus

Geographic distribution: England (Smith 1937), Japan (Asuyama 1938, Fukushi 1932), United States

Host range: CARYOPHYLLACEAE—*Dianthus caryophyllus* L.

Symptoms: Light and dark green mottling in young leaves, later whitish, sunken, elongated streaks, eventually becoming reddish, purplish or brown. Similar streaks in stems. Light-colored streaks and distortion in flowers (Creager 1943). Symptoms are most conspicuous in late fall, winter, and early spring (Creager 1944).

Methods of transmission: By sap (Jones). By grafting (Jones, Creager). By aphids (unspecified)(Jones 1940).

Properties: Not determined

Remarks:
Jones states (1942) that 2 viruses appear to be associated with the disease.

Literature:

Asuyama, H. New diseases and pathogens reported recently on the cultivated plants of Japan IV. Ann. Phytopath. Soc. Japan 7 (3-4): 231-236. 1938. (Japanese) (RAM 17: 506).

Creager, D. B. Carnation mosaic. Phytopath. 33: 823-827. 1943.

__________ How to recognize and control mosaic on carnation plants. Flor. Rev. 93 (2409): 27-29. 1944

Fukushi, T. A contribution to our knowledge of virus diseases of plants in Japan. Trans. Sapporo Nat. Hist. Soc. 12: 130-141. 1932.

Jones, L. K. Carnation yellows. *In* Fiftieth Annual Report for the fiscal year ended June 30, 1940. Wash. Agric. Exp. Sta. Bull. 394: 76-77. 1940.

__________ Carnation yellows. *In* Fifty-second Annual Report for the fiscal year ended June 30, 1942. Wash. Agric. Exp. Sta. Bull. 425: 74. 1942.

Smith, K. M. A textbook of plant virus diseases. London 1937. p. 554.

EMILIA-VARIEGATION VIRUS

Name:

Synonyms: Emilia disease virus (Loos).

Common name: Emilia-variegation virus

Geographic distribution: Ceylon.

Host range: COMPOSITAE—Emilia scabra DC.

Symptoms: Yellow vein banding.

Methods of transmission: By grafting (Symptoms after 11 to 14 days). Not by sap.

Properties: Not determined.

Remarks:
Attempts to infect tobacco failed. The symptoms of this disease are distinct from those of tomato-spotted-wilt virus in Emilia scabra. This plant is a weed.

Literature:
Loos, C. A. A virus disease of Emilia scabra. Trop. Agriculturist (Ceylon) 97: 18-21. 1941.

EPIPHYLLUM-MOSAIC VIRUS

Name:

Synonyms: Epiphyllum-mosaic virus Blattný & Vukolov 1932

Common name: Epiphyllum-mosaic virus.

Geographic distribution: Czechoslovakia, Germany.

Host range: CACTACEAE—Epiphyllum truncatum Haw. and varieties, E. bridgesii Lem., Pereskia aculeata Mill., Phyllocactus gaertneri (Regel) Schum. var. mackoyanus, Rhipsalis rosea Lagerh.

Symptoms: In Epiphyllum truncatum, early stages show scattered, pale, diffuse-bordered, somewhat sunken spots, best seen by transmitted light; in mid-stages these spots coalesce irregularly to form large whitish-green blotches, thinner than normal; in advanced stages these blotches dry and turn brown, occasionally fall out. Dwarfing, distortion, delayed flowering, premature death characterize severe infections. The epidermis is much thinner than normal, all tissue elements reduced in size, and chloroplasts fewer in diseased tissues. Blattný and Vukolov 1932.

Methods of transmission: By grafting, by sap, by Orthezia insignis Dougl. (Hemiptera-Coccidae) (Blattný and Vukolov 1932)

Properties: Not determined.

Remarks:
Blattný & Vukolov (1932) and Pape (1932) illustrate mosaic symptoms in Epiphyllum. Blattný & Vukolov report experimental infection of 1/30 Epiphyllum truncatum plants by sap, 4/30 by Orthezia insignis, 5/30 by injection of crushed infective Orthezia, 0/30 by injection of dried Epiphyllum stem material, 0/30 in controls, no infection by larvae raised from eggs of infective Orthezia. They showed that Pereskia aculeata, often used as a stock for Epiphyllum, can serve as a symptomless carrier. Pape (1932) reports symptoms in several varieties of Epiphyllum truncatum, and also in E. bridgesii, Phyllocactus gaertneri var. mackoyanus, and Rhipsalis rosea, but records no transmission experiments. Weingart (1920) reports one successful graft transfer from Opuntia monacantha variegata to the green species, white spotting appearing in the stock in the following summer.

Literature:

Blattný, C., and Vukolov, V. Mosaik bei Epiphyllum truncatum. Gartenbauwissenschaft. 6: 425-432. 1932.

Pape, H. Mosaikkrankheit an Glieder-, Blatt- und Rutenkakteen. Gartenwelt 36: 707-708, 731-732. 1932.

Weingart, W. Buntgefleckte-Kakteen. Monatschr. Kakteenk. 30: 145-147. 1920.

EUONYMUS-VARIEGATION VIRUS

Name: Marmor euonymi Holmes 1939. p. 51

Synonyms: Euonymus infectious chlorosis (virus) Baur

Common name: Euonymus-variegation virus

Geographic distribution: Germany, Japan, United States

Host range: CELASTRACEAE--Euonymus japonicus L., E. fortunei var. radicans (Miq.) Rehd. (E. radicans).

Symptoms: Chlorosis appears as pale streaks, continuous or interrupted, along the veins of young leaves. These mask with further growth of the leaf, but pale flecks appear in the mesophyll which persist in fully expanded leaves (Rischkow).

Methods of transmission: By grafting (Bouché, Baur, Davis), and budding. Not by sap (Davis).

Properties: Not determined.

Remarks:

The conspicuous golden variegations in ornamental forms of Euonymus are genetic, but may mask the veinal chlorosis which is infectious. Green and yellow areas are more sharply demarked in the genetic variegations (Rischkow).

Literature:

Baur, E. Über eine infektiöse Chlorose von Evonymus japonicus. Bericht. d. Deutsch. Bot. Gesellsch. 26a: 711-713. 1908.

Bouché, C. Ueber das Buntwerden der Blätter als krankhafte Ansteckung durch Pfropfreiser bei Evonymus japonicus, wie bei Abutilon. Gesellsch. Naturforsch. Freunde Berlin, Sitzungsber. 1871: 66-68. 1871 (Not seen).

Davis, E. F. Some chemical and physiological studies on the nature and transmission of "infectious chlorosis" in variegated plants. Ann. Missouri Bot. Gard. 16: 145-226. 1929.

Fukushi, T. A contribution to our knowledge of virus diseases of plants in Japan. Trans. Sapporo Nat. Hist. Soc. 12: 130-141. 1932.

Holmes, F. O. A handbook of phytopathogenic viruses. Minneapolis 1939. p. 51.

Rischkow, W. Neue Daten über geaderte Panaschierung bei Evonymus japonicus und Evon. radicans. Biol. Zentralbl. 47: 752-764. 1927.

FRAXINUS-VARIEGATION VIRUS

Name:

Synonyms: Fraxinus infectious chlorosis (virus) Baur 1907

Common name: Fraxinus-variegation virus

Geographic distribution: England, Germany, Bulgaria.

Host range: OLEACEAE--Fraxinus americana L., F. excelsior L., F. pennsylvanica Marsh. (F. pubescens Lam.).

Symptoms: Systemic yellow chlorotic leaf spotting.

Methods of transmission: By grafting (Syme, Baur).

Properties: Not determined.

Remarks:

Scions of Fraxinus pennsylvanica var. aucubaefolia (K. Koch) Rehd., an ornamental variety, transferred the virus to green F. pennsylvanica stocks. Earlier records of transfer are cited by Baur 1907, and by Atanasoff 1935.

Literature:

Atanasoff, D. Old and new virus diseases of trees and shrubs. Phytopath. Zeitschr. 8: 197-223. 1935.

Baur, E. Über infektiöse Chlorosen bei _Ligustrum_, _Laburnum_, _Fraxinus_, _Sorbus_ und _Ptelea_. Bericht. d. Deutsch. Bot. Gesellsch. 25: 410-413. 1907.

Syme, G. The influence of the bud on the stock. Gard. Chron. n. s. 8: 246. 1877.

GLADIOLUS-MOSAIC VIRUS

Name:

Synonyms:

Common name: Gladiolus-mosaic virus.

Geographic distribution: Widespread—Canada, England, Brazil, United States, Venezuela, Japan.

Host range: IRIDACEAE—_Gladiolus_ hybrids.

Symptoms: Systemic chlorotic mottling in leaves; breaking of the flower color.

Methods of transmission: Not by sap. By _Myzus_ _circumflexus_ Buckt., _M._ _persicae_ Sulz. Not through seed.

Properties: Not determined.

Remarks:

Dosdall (but not Smith and Brierley) noted stunting of affected plants and malformation of corms. Smith and Brierley report similar mosaic viruses in _Babiana_, _Ixia_, _Sparaxis_, _Streptanthera_, _Tigridia_, _Tritonia_, and _Watsonia_, transmissible by _Myzus_ _persicae_.

Literature:

Dimock, A. W. The season's No. 1 gladiolus disease—mosaic. Gladiolus (Yearbk. New Engl. Gladiolus Soc.) 16 (1941): 117-123. c1940

Dosdall, Louise. A mosaic disease of gladiolus. Phytopath. 18: 215-217. 1927.

Drayton, F. L. Studies and notes on the diseases of ornamental plants. Rept. Dominion Botanist for the year 1927, Div. of Botany, Canada Dept. of Agric. pp. 15-31. 1928.

Fukushi, T. A contribution to our knowledge of virus diseases of plants. Trans. Sapporo Nat. Hist. Soc. 12: 130-141. 1932.

Müller, A. S. Brazil: preliminary list of diseases of ornamental plants in the State of Minas Geraes. Internat. Bull. Pl. Prot. 9 (5): 104-105. 1935. (RAM 14: 634).

____________ El reconocimiento de las enfermedades de las plantas cultivadas en Venezuela. 1937-1941. Bol. Soc. venez. Cien. nat. 7 (48): 99-113. 1941. (RAM 21: 324. 1942).

Smith, Floyd F., and Philip Brierley. Preliminary report on some mosaic diseases of Iridaceous plants. Phytopath. 34: 1944. (in press).
Williams, P. H., Oyler, Enid, White, H. L., Ainsworth, G. C., and W. H. Read. Plant diseases. Rep. Exp. Sta. Cheshunt 1938: 39-63. 1939. (RAM 18: 783).

HOLODISCUS-WITCHES'-BROOM VIRUS

Name: Holodiscus Virus 1 (Zeller) Smith 1937
Nanus holodisci Holmes 1939

Synonyms: Holodiscus-witches'-broom virus Zeller 1931

Common name: Holodiscus-witches'-broom virus

Geographic distribution: Oregon, Washington.

Host range: ROSACEAE--*Holodiscus discolor* (Pursh) Maxim.

Symptoms: Lateral buds proliferate to form slender shoots with short internodes and small leaves. Plants appear stiff and leafy, usually fail to bloom, and assume a bronzy-red color in early summer.

Methods of transmission: Transmissible by grafting, not by sap. By *Aphis spireae* Schout.

Properties: Not determined.

Literature:

Holmes, F. O. Handbook of phytopathogenic viruses. Minneapolis 1939. p. 127-128.
Smith, K. M. A textbook of plant virus diseases. London 1937. p. 127-128.
Zeller, S. M. A witches' broom of ocean spray (*Holodiscus discolor*). Phytopath. 21: 923-925. 1931.

(HUMULUS) HOP-CHLOROTIC-DISEASE VIRUS

Name: Humulus Virus 3 (Salmon and Ware) Smith 1937

Synonyms: Hop chlorotic disease virus Salmon and Ware 1930

Common name: Hop-chlorotic-disease virus.

Geographic distribution: Worcestershire, England.

Host range: MORACEAE--*Humulus lupulus* L.

Symptoms: Weak growth. In leaves yellow mottling, banding, or general yellowing except at the leaf tips. Sometimes marked curling. Chlor-

otic areas much thinner than normal, with fewer cell layers, shorter palisade cells, and fewer chloroplasts. Illustrated by Salmon and Ware 1930.

Methods of transmission: By budding and grafting (1930). By sap (1932a). No vector is known. Apparently through seed (1935) (Salmon and Ware).

Properties: Not determined.

Literature:

Salmon, E. S., and Ware, W. M. The chlorotic disease of the hop. Ann. Appl. Biol. 17: 241-247. 1930.

____________, and __________ The chlorotic disease of the hop. II. Ann. Appl. Biol. 19: 6-15. 1932 (a)

____________, and __________ The chlorotic disease of the hop. III. Ann. Appl. Biol. 19: 518-528. 1932 (b).

____________, and __________ The chlorotic disease of the hop. IV. Transmission by seed. Ann. Appl. Biol. 22: 728-730. 1935.

Smith, K. M. A textbook of plant virus diseases. London 1937. p. 194-196.

(HUMULUS) HOP-INFECTIOUS-STERILITY VIRUS

Name:

Synonyms:

Common name: Hop-infectious-sterility virus Blattný and Vukolov 1935

Geographic distribution: Czechoslovakia.

Host range: MORACEAE—*Humulus lupulus* L.

Symptoms: Total or nearly total unfruitfulness. Plants usually reach normal height, but produce few laterals. Apical shoots profusely developed with short internodes and necrotic tips. Leaves sometimes curled backward and distorted. Phloem necrosis is general in terminal and lateral growing points, also in petioles and leaf veins.

Methods of transmission: By grafting. Not by sap. Not by soil. No vector is known.

Properties: Not determined.

Literature:

Blattný, C., and Vukolov, V. Nakažlivá neplodnost chmele. Rec. Inst. Rech. agron. Rép. Tchecoslovaque 137, p. 3-18 (German summary). 1935.

Goodwin, W., and Salmon, E. S. Infectious sterility in hop gardens in Czechoslovakia. Jour. Inst. Brew. n. s. 33: 209-210. 1936

(HUMULUS) HOP-MOSAIC VIRUS

Name: Humulus Virus 1 (Salmon) Smith 1937

Synonyms: Hop mosaic virus Salmon 1923
Hop false nettlehead virus Duffield 1925

Common name: Hop-mosaic virus

Geographic distribution: Widespread in Europe—Czechoslovakia, England, Germany, Poland (Smith 1937); possibly United States (Chupp 1933).

Host range: MORACEAE—Humulus lupulus L.

Symptoms: Plants are dwarfed, fail to cling to supports, bear malformed cones or none. The upper part of the stem is brittle, sometimes dies back. Leaves are brittle, mottled green and yellow, with margins curled downward and inward. The disease is eventually fatal (Salmon 1923).

Methods of transmission: By grafting (Thrupp 1927). Not by sap (Salmon 1925). Not through soil (Salmon 1936). No vector is known.

Properties: Not determined.

Remarks:
Many American, Danish, English, German, and seedling varieties and some male hops are symptomless carriers of mosaic (MacKenzie et al 1929).

Literature:

Cheal, W. F. Investigations of hop mosaic disease in the field. Ann. Appl. Biol. 16: 230-235. 1929.

Chupp, C. Downy mildew of hops in New York. Plant Disease Reporter 17: 103-104. 1933.

Duffield, C. A. W. Nettlehead in hops. Ann. Appl. Biol. 12: 536-543. 1925.

MacKenzie, D., Salmon, E. S., Ware, W. M., and Williams, R. The mosaic disease of the hop; grafting experiments, II. Ann. Appl. Biol. 16: 359-381. 1929.

Salmon, E. S. The "mosaic" disease of the hop. Journ. Min. Agr. 29: 927-934. 1923.

__________ Fungus and virus diseases of the hop. Journ. Inst. Brew. n. s. 33: 184-186. 1936.

__________, and Ware, W. M. The mosaic disease of the hop; grafting experiments, I. Ann. Appl. Biol. 15: 342-351. 1928.

Smith, K. M. A textbook of plant virus diseases. London 1937. p. 193.

Thrupp, T. C. The transmission of mosaic disease in hops by means of grafting. Ann. Appl. Biol. 14: 175-180. 1927

(HUMULUS) HOP-NETTLEHEAD VIRUS

Name: Chlorogenus humuli Holmes 1939
Humulus Virus 2 (Duffield) Smith 1937

Synonyms: Hop nettlehead (virus) Duffield 1925
Hop-nettlehead virus Salmon and Ware 1930
? Kräuselkrankheit (virus) Blattný 1930

Common name: Hop-nettlehead virus

Geographic distribution: England. A somewhat similar disease of hops is known in Czechoslovakia, Germany, and Poland. (Smith).

Host range: MORACEAE—Humulus lupulus L.

Symptoms: Brooming, clusters of weak shoots, upward curling and elongation of leaves, barrenness.

Methods of transmission: By grafting (Keyworth, 1941, 1942). Not by sap. No vector is known.

Properties: Not determined.

Literature:

Blattný, C. Studie o kadeřavosti Chmele. Rec. Inst. Rech. agron. Rép. Tchecoslovaque 56, 44 pp. (German summary) 1930.
Duffield, C. A. W. Nettlehead in hops. Ann. Appl. Biol. 12: 536-543. 1925.
Keyworth, W. G. Verticillium wilt and virus diseases of the hop. Ann. Appl. Biol. 29: 323-324. 1942.
__________ Notes on hop diseases in 1941. East Malling Res. Sta. Ann. Rept. (29th) 1941: 42-43. 1941.
Salmon, E. S. Fungus and virus diseases of the hop. Journ. Inst. Brew. n. s. 33: 184-186. 1936.
__________ Diseases of hops. Journ. Inst. Brew. n. s. 32: 235-237. 1935.
__________, and Ware, W. M. "Nettlehead" disease of the hop. In Report from the Mycological Department. Journ. S.-Eastern Agric. Coll. 27: 95. 1930.
Smith, K. M. A textbook of plant virus diseases. London 1937. p. 194.

HYDRANGEA-VIRESCENCE VIRUS

Name:

Synonyms: Hortensia-Vergrünung (virus)

Common name: Hydrangea-virescence virus

Geographic distribution: Germany.

Host range: SAXIFRAGACEAE—*Hydrangea macrophylla* (Thunb.) DC. (*H. opuloides* K. Koch).

Symptoms: Green discoloration of the flowers.

Methods of transmission: By grafting.

Properties: Not determined.

Literature:

Muth, F. Über vergrünte Hortensien. In Bericht der Lehr- und Forschungsanstalt für Wein-, Obst- und Gartenbau zu Geisenheim a. Rh. für Rechnungsjahre 1931-32. Landw. Jahrb. 77 (Ergänzungsband): 222-223. 1933

HYOSCYAMUS-MOSAIC VIRUS

Name: *Hyoscyamus Virus 1* (Hamilton) Smith 1937

Synonyms: Hyoscyamus virus III (Hy III) Hamilton 1932

Common name: Hyoscyamus-mosaic virus

Geographic distribution: England.

Host range: SOLANACEAE—*Hyoscyamus niger* L., *Datura stramonium* L., *Lycopersicon esculentum* Mill., *Nicotiana tabacum* L., *N. glutinosa* L., *N. glauca* Graham, *Petunia* sp. (Hamilton 1932).

Symptoms: In *Hyoscyamus niger*, clearing of veins followed by yellow mosaic with dark green vein-banding. In *Datura stramonium*, yellow mosaic with tendency to dark green vein-bands and blistering. In tomato, mottling, stunting, marked curling of leaves. In tobacco, yellow mottling with blistered dark green bands. In *Nicotiana glutinosa*, systemic vein-banding in 14-15 days, white stripe flower break. In *N. glauca*, violent necrosis, blistering, stunting. In Petunia, yellow vein-banding, necrosis in older leaves. Sometimes lethal to tobacco and Hyoscyamus (Hamilton 1932). Intracellular inclusions present (Hamilton 1932, Sheffield 1934, Bawden & Kassanis 1941).

Methods of transmission: By sap. By *Myzus persicae* (Sulz.) (Hamilton 1932). By *Macrosiphum gei* (Koch), *Myzus circumflexus* (Buckt.) (Watson & Roberts 1939). Not through seed (Caldwell 1934).

Properties: Thermal inactivation point between 50° and 60°C. Resistance to aging less than 6 days (Watson 1936). Active in dilutions of 1 to 10,000 (Watson & Roberts 1939). Filterable through Chamberland L1 candle, not through L3 (Hamilton 1932). Passes collodion membranes of pore size 0.30 µ but not 0.234 µ (MacClement & Smith 1932). Hyoscyamus virus 3 has yielded liquid crystalline

nucleoprotein preparations showing anisotropy of flow and with properties similar to those of preparations from potato virus Y. Yields are 1-3 mg. per liter of sap. The protein gives specific precipitates with antisera and is infective. (Bawden & Pirie 1939).

Remarks:

Hyoscyamus virus 3, potato virus Y, and tobacco-severe-etch virus are transmitted by the same insects in the "non-persistent" manner and have essentially similar properties. The viruses are not serologically related, and tobacco plants infected with Hyoscyamus virus 3 or potato virus Y are not protected against tobacco-severe-etch virus. Potato virus Y and Hyoscyamus virus 3 may be regarded as separate species of the same genus as tobacco-severe-etch virus (Bawden & Kassanis 1941).

Three strains of Hyoscyamus virus 3 isolated by single aphids from the parent strain are distinguished as a virulent strain, a weak strain, and a yellow strain (Watson & Roberts 1939).

Hyoscyamus virus 3 belongs to the "non-persistent" group of viruses which are transmitted by aphids, survive for a brief period in their vectors, lack a "latent period" in these vectors, and are transmitted most efficiently (a) when the vector is starved for 1 hour or more before feeding on the source plant, and (b) when the feeding time on the source plant is short (2 minutes) (Watson & Roberts 1939).

Literature:

Bawden, F. C., and Kassanis, B. Some properties of tobacco etch viruses. Ann. Appl. Biol. 28: 107-118. 1941.

____________, and Pirie, N. W. The purification of insect-transmitted plant viruses. Brit. Journ. Exp. Path. 20: 322-329. 1939.

Caldwell, J. The physiology of virus diseases in plants. V. The movement of the virus agent in tobacco and tomato. Ann. Appl. Biol. 21: 191-205. 1934.

Hamilton, M. A. On three new virus diseases of _Hyoscyamus niger_. Ann. Appl. Biol. 19: 550-567. 1932.

MacClement, D., and Smith, J. H. Filtration of plant viruses. Nature 130: 129-130. 1932.

Sheffield, F. M. L. Experiments bearing on the nature of intracellular inclusions in plant virus diseases. Ann. Appl. Biol. 21: 430-453. 1934.

Smith, K. M. A textbook of plant virus diseases. London 1937. p. 331.

Watson, M. A. Factors affecting the amount of infection obtained by aphis transmission of Virus Hy. III. Phil. Trans. Roy. Soc. 226: 457-489. 1936.

____________ Further studies on the relationship between Hyoscyamus virus 3 and the aphid _Myzus persicae_ (Sulz.) with special reference to the effects of fasting. Proc. Roy. Soc. B. 125: 144-170. 1938

____________, and Roberts, F. M. A comparative study of the transmission of Hyoscyamus virus 3, potato virus Y and cucumber virus 1 by the vectors _Myzus persicae_ (Sulz.), _M. circumflexus_ (Buckton) and _Macrosiphum gei_ (Koch). Proc. Roy. Soc. B. 127: 543-576. 1939.

ILEX-VARIEGATION VIRUS

Name:

Synonyms:

Common name: Ilex-variegation virus

Geographic distribution: England, France.

Host range: AQUIFOLIACEAE--*Ilex* spp.

Symptoms: Variegation.

Methods of transmission: By grafting (Blair 1719, Carrière 1887).

Properties: Not determined.

Literature:

Atanasoff, D. Old and new virus diseases of trees and shrubs. Phytopath. Zeitschr. 8: 197-223. 1935.

Blair, P. Botanic Essays. London 1719. pp. 383-386 (cited by Atanasoff).

Carrière, E. A. Influence du greffon sur le sujet. Revue Horticole 59: 58-59. 1887.

IRIS-MOSAIC VIRUS

Name: *Iris Virus 1* (Brierley & McWhorter) Smith 1937
Marmor iridis Holmes 1939

Synonyms: Iris mosaic virus
Iris stripe virus

Common name: Iris-mosaic virus

Geographic distribution: Widespread. Denmark, England, France, Holland, Japan, Sweden, United States.

Host range: IRIDACEAE--*Iris filifolia* Boiss., *I. pumila* L., *I. ricardi* Hort., *I. tectorum* Maxim., *I. tingitana* Boiss & Reut., *I. unguicularis* Poir., *I. xiphium* L.

Symptoms: Mottling of leaves, breaking of flower colors.

Methods of transmission: By sap. By the aphids, *Myzus persicae* Sulz., *Macrosiphum solanifolii* Ashm. (= *Illinoia solanifolii* Ashm.).

Properties: Not determined.

Literature:

Brierley, P., and McWhorter, F. P. A mosaic disease of bulbous iris. Phytopath. 24: 4. 1934 (Abst.)

Brierley, P., and McWhorter, F. P. A mosaic disease of iris. Journ. Agric. Res. 53: 621-635. 1936.
Dufrenoy, J. Die Viruskrankheiten. Phytopath. Zeitschr. 5: 85-90. 1932.
Fukushi, T. A contribution to our knowledge of virus diseases of plants in Japan. Trans. Sapporo Nat. Hist. Soc. 12: 130-141. 1932.
Holmes, F. O. Handbook of phytopathogenic viruses. Minneapolis 1939. p. 55-56.
Ingelström, E. Några aktuella sjukdomar på prydnadsvaxter. Växtskyddsnotiser Växtyskyddsinst. Stockh. 1938 (2): 22-24. 1938. (RAM 17: 752).
Neergaard, P. Nye eller upaaagtede Prydplantssygdomme i Danmark 9-12. Reprinted from Gartnertidende 1940, 4 pp. 1940 (RAM 20: 579).
Smith, K. M. A textbook of plant virus diseases. London 1937 p. 420-422.

JASMINUM-VARIEGATION VIRUS

Name:

Synonyms:

Common name: Jasmine-variegation virus

Geographic distribution: Belgium, England, Germany.

Host range: OLEACEAE--*Jasminum revolutum* Sims, *J. officinalis* L.

Symptoms: Yellow variegation in leaves and young branches.

Methods of transmission: By grafting or budding (Lawrence 1715, Blair 1719, Cane 1720, Godsall 1869).

Properties: Not determined.

Literature:

Atanasoff, D. Old and new virus diseases of trees and shrubs. Phytopath. Zeitschr. 8: 197-223. 1935.
Blair, P. Botanic essays. pp. 383-386. London 1715. (Cited by Atanasoff).
Cane, H. An account of two observations in gardening, upon the changes in color in grapes and Jessamine. Roy. Soc. Phil. Trans. Ser. B. 31: 102. 1720. (Cited by Atanasoff).
Godsall, W. Gard. Chron. 1869: 838. 1869.
Lawrence, John. The clergyman's recreation. London. 1715. p. 95. (Extract by W. A. Orton. An early report on infectious chlorosis. Phytopath. 14: 198-199. 1924).
Smith, K. M. A textbook of plant virus diseases. London 1937. p. 554.

LABURNUM-VARIEGATION VIRUS

Name: Marmor laburni Holmes 1939. p. 51

Synonyms: Laburnum infectious chlorosis (virus) Baur 1906

Common name: Laburnum-variegation virus

Geographic distribution: Bulgaria, England, Germany.

Host range: LEGUMINOSAE--Cytisus hirsutus L. (Baur 1907), Laburnum anagyroides Medik. (L. vulgare Griseb.)

Symptoms: Green and yellow leaf variegation.

Methods of transmission: By grafting (Masters 1877), budding, or transplantation of bark (Baur 1907). Not through seed.

Properties: Not determined.

Remarks:
Laburnum vulgare chrysophyllum exhibits a uniform yellowish chlorosis of leaves; L. vulgare foliis aureis shows golden variegation in leaves and young bark; both forms are produced by the same infectious chlorosis in different clons of L. vulgare. L. alpinum and Cytisus purpureus are insusceptible plants (Baur 1906, 1907).

Literature:

Atanasoff, D. Old and new virus diseases of trees and shrubs. Phytopath. Zeitschr. 8 (2): 197-223. 1935.
Baur, E. Weitere Mitteilungen über die infektiöse Chlorose der Malvaceen und über einige analoge Erscheinungen bei Ligustrum und Laburnum. Bericht. d. Deutsch. Bot. Gesellsch. 24: 416-428. 1906.
_______ Über infektiöse Chlorosen bei Ligustrum, Laburnum, Fraxinus, Sorbus, und Ptelea. Bericht. d. Deutsch. Bot. Gesellsch. 25: 410-413. 1907.
Holmes, F. O. Handbook of phytopathogenic viruses. Minneapolis 1939. p. 51.
Masters, M. T. Action of scion on stock. Gard. Chron. 7: 730. 1877.
Smith, K. M. A textbook of plant virus diseases. London 1937. p. 555.

(LATHYRUS) SWEETPEA-STREAK VIRUS

Name:

Synonyms:

Common name: Sweetpea-streak virus

Geographic distribution: England (Ainsworth 1940) (Widespread if this virus is a leading causal agent of sweetpea streak, formerly attributed to _Bacillus lathyri_).

Host range: LEGUMINOSAE--_Lathyrus odoratus_ L., _Phaseolus vulgaris_ L., _Pisum sativum_ L. var. The Lincoln (but not var. Perfection), _Trifolium repens_ L., _Vicia faba_ L.

Symptoms: In _Lathyrus odoratus_ brown necrotic streak lesions in stems and petioles, mosaic mottling of leaves, breaking of flower color. In _Pisum sativum_, mottling, stunting, vein necrosis, occasionally death. In _Vicia faba_, reddish brown streaks, stunting. In _Phaseolus vulgaris_, systemic mottling. In _Trifolium repens_, mild mosaic mottling.

Methods of transmission: By sap.

Properties: Thermal inactivation between 50° and 55°C. Withstands aging in expressed juice 24 hours, not 48 hours.

Remarks:

Sweetpea-streak virus, isolated from naturally affected sweetpeas, proved distinct from the viruses of bean mosaic, mild, yellow, and enation pea mosaics, lettuce mosaic, cucumber mosaic, and tomato spotted wilt, which were compared with it, and appeared allied to bean virus 2 (Pierce 1934; Zaumeyer & Wade 1935 (pea virus 2)), white sweetclover mosaic virus (Zaumeyer & Wade 1935, 1936), and the severe pea mosaic of Johnson and Jones (1937). Although sweetpea-streak virus appears to belong to the same group as the 3 viruses last named, it cannot with certainty be identified with any of these (Ainsworth 1940).

Literature:

Ainsworth, G. C. The identification of certain viruses found infecting leguminous plants in Great Britain. Ann. Appl. Biol. 27: 218-226. 1940.

Johnson, F., and Jones, L. K. Two mosaic diseases of pea in Washington. Journ. Agric. Res. 54: 629-638. 1937.

Pierce, W. H. Viroses of the bean. Phytopath. 24: 87-115. 1934.

Zaumeyer, W. J., and Wade, B. L. The relationship of certain legume mosaics to bean. Journ. Agric. Res. 51: 715-749. 1935.

__________, and ________ Pea mosaic and its relation to other legume mosaic viruses. Journ. Agric. Res. 53: 161-185. 1936.

LIGUSTRUM-VARIEGATION VIRUS

Name: _Marmor ligustri_ Holmes 1939, p. 52

Synonyms: Ligustrum infectious chlorosis (virus) Baur 1906

Common name: Ligustrum-variegation virus

Geographic distribution: Germany

Host range: OLEACEAE--Ligustrum vulgare L.

Symptoms: Clear yellow leaf spotting.

Methods of transmission: By grafting or budding. Not through seed.

Properties: Not determined.

Remarks:
Baur (1906) found infectious chlorosis present in the yellow-mottled variety *Ligustrum vulgare foliis aureovariegatis* but not in the white-margined variety or the *aureum* variety.

Literature:

Baur, E. Weitere Mitteilungen über die infektiöse Chlorose der Malvaceen und über einige analoge Erscheinungen bei *Ligustrum* und *Laburnum*. Bericht. d. Deutsch. Bot. Gesellsch. 24: 416-428. 1906.

_______ Über infektiöse Chlorosen bei *Ligustrum*, *Laburnum*, *Fraxinus*, *Sorbus*, und *Ptelea*. Bericht. d. Deutsch. Bot. Gesellsch. 25: 410-413. 1907.

Holmes, F. O. Handbook of phytopathogenic viruses. Minneapolis 1939. p. 52.

(LILIUM) LILY-ROSETTE VIRUS

Name: *Lilium Virus 1* (Ogilvie) Smith 1937

Synonyms: Lily yellow flat virus (Ogilvie 1928).
Lily rosette virus (British Mycol. Society 1929).

Common name: Lily-rosette virus.

Geographic distribution: Bermuda, England (Cotton 1933), Holland Van Poeteren 1929), Japan (Kawamura 1938), Java (Van Der Goot 1934), United States.

Host range: LILIACEAE--*Lilium longiflorum* Thunb., possibly also *L. auratum* Lindl. (Smith 1936), and *L. batemanniae* Wallace (Guterman 1930).

Symptoms: Dwarfing, yellowing. Downward curling of leaves. Early maturity.

Methods of transmission: By *Aphis gossypii* Glover. Not by sap. Not through seed.

Properties: Not determined.

Remarks:
This virus has been experimentally transmitted to *Lilium longiflorum* and its varieties only, but similar symptoms in *L. batemanniae* are reported by Guterman (1930) and in *L. auratum* by Smith (1936).

Literature:

British Mycological Society. List of common names of British plant diseases. Trans. Brit. Mycol. Soc. 14: 140-177. 1929

Cotton, A. D. The detection and control of lily diseases. Royal Hort. Soc. Lily Year Book 1933: 194-210. 1933.

Dufrenoy, J. Changes in the structure of the cells induced by the 'yellow flat' virus disease of Easter lilies. Proc. Louisiana Acad. Sci. 6: 35. 1942.

Guterman, C. E. F. Final summary of the work on diseases of lilies for the lily disease investigation fellowship. Yearbook New York Hort. Soc. 1930: 51-102. 1930.

Kawamura, T. So-called virus diseases of lily in relation to hosts. Ann. Phytopath. Soc. Japan 7: 163-172. 1938.

Ogilvie, L. An important virus disease of Lilium longiflorum and its varieties. Nature 119 (2997): 528. 1927.

__________ A transmissible virus disease of the Easter lily. Ann. Appl. Biol. 15: 540-562. 1928.

Smith, K. M. The virus diseases of glasshouse and garden plants. Sci. Hort. 4: 126-140. 1936.

__________ A textbook of plant virus diseases. London 1937, p. 415.

Van Der Goot, P. Ziekten en plagen der cultuurgewassen in Nederlandsch-Indie in 1932. Meded. Inst. voor Plantenziekten, 83, 80 pp. 1934 (RAM 14: 153).

Van Poeteren, N. Verslag over de werkzaamheden van den Plantenziektenkundigen Dienst in het jaar 1929. Versl. en Meded. Plantenziektenkundigen Dienst te Wageningen, 62, 142 pp. 1930 (RAM 10: 293).

(LILIUM) LILY-SYMPTOMLESS VIRUS

Name: Adelonosus lilii Brierley and Smith 1944

Synonyms:

Common name: Lily-symptomless virus

Geographic distribution: Bermuda, Japan, United States.

Host range: LILIACEAE--Lilium longiflorum Thunb.

Symptoms: No symptoms alone; necrotic fleck when present together with cucumber- mosaic virus (Marmor cucumeris Holmes 1939).

Methods of transmission: By sap (with difficulty). By Aphis gossypii Glover. Not through seed.

Properties: Not determined.

Remarks:

An essential constituent of necrotic fleck in Lilium longiflorum, this virus is present where necrotic fleck occurs, hence is practically coextensive with commercial culture of Easter lilies. Earlier literature on the necrotic fleck disease of Easter lily is reviewed by

Brierley & Smith. This virus has a latent period of a few days in the vector *Aphis gossypii*. It fails to protect against lily-rosette virus.

Literature:
Brierley, P., and Smith, Floyd F. Studies on lily virus diseases: the necrotic fleck complex in *Lilium longiflorum*. Phytopath. 34: 1944. (in press).

LONICERA-VARIEGATION VIRUS

Name:

Synonyms: Lonicera variegation-inducing agent Woods and DuBuy

Common name: Lonicera-variegation virus

Geographic distribution: Belgium, United States.

Host range: CAPRIFOLIACEAE--*Lonicera japonica* Thunb. (Synonym *L. brachypoda reticulata* Witte, of horticulture).

Symptoms: Vein-yellowing variegation.

Methods of transmission: By grafting.

Properties: Not determined.

Literature:
Woods, M. W., and H. G. DuBuy. Evidence for the evolution of pathogenic viruses from mitochondria and their derivatives. I. Cytological and genetic evidence. Phytopath. 33: 637-655. 1943.

MATTHIOLA-MILD-MOSAIC VIRUS

Name: *Matthiola Virus 1* (Tompkins) Smith 1937

Synonyms: Matthiola-breaking virus Tompkins 1934
Matthiola mild mosaic virus Tompkins 1939
? Matthiola panache Chaté 1867
? Wallflower mosaic virus Smith 1937. p. 19

Common name: Matthiola-mild-mosaic virus

Geographic distribution: California (Tompkins 1934), England? (Smith 1937), France? (Chaté 1867), Australia? (Noble et al 1934), Italy? (Gigante 1936).

Host range: CHENOPODIACEAE--*Chenopodium murale* L. Cruciferae--*Alyssum maritimum* Lam., *Brassica adpressa* (Moench) Boiss., *B. alba* (L.) Boiss., *B. juncea* (L.) Coss., *B. kaber* (DC.) L. C. Wheeler

(B. arvensis (L.) Ktze.), B. nigra (L.) Koch., B. pekinensis Rupr. (B. pe-tsai Bailey), B. rapa L., Capsella bursa-pastoris (L.) Medik., Cheiranthus cheiri L., Hesperis matronalis L., Lunaria annua L., Malcomia maritima (L.) R.Br., Matthiola incana (L.) R. Br. var. annua (L.) Voss., M. bicornis (Sibth. & Sm.) DC., Raphanus sativus L., R. sativus var. longipinnatus Bailey. RESEDACEAE--Reseda odorata L. SOLANACEAE--Nicotiana glutinosa L., N. langsdorffii Weinm., N. tabacum L.

Symptoms: In annual stocks, vein clearing followed by mild mottling in leaves, mild breaking of flower color in all but white or yellow varieties. In Nicotiana langsdorffii, systemic mottling; in N. glutinosa and N. tabacum, necrotic local lesions. No infection in Chenopodium album L., Spinacia oleracea L., or Petunia hybrida Vilm.

Methods of transmission: By sap (symptoms after about 20 days). Not by seed. By Brevicoryne brassicae (L.), Lipaphis pseudobrassicae (Davis), Myzus persicae (Sulz.).

Properties: Thermal inactivation point at or near 60°C. Dilution tolerance 1:4000. Withstands aging in vitro between 5 and 6 days at 22°C.

Remarks:

Failure to infect kale, Brussels sprouts, cabbage, cauliflower, sprouting broccoli, kohlrabi, and rape, characterizes both Matthiola mild mosaic and Matthiola severe mosaic, and serves to distinguish these viruses from certain other crucifer viruses.

Interpretation of distribution records based on observation of symptoms is impracticable, as "Flower breaking of annual stock may also be induced by the Chinese cabbage, turnip, horseradish, and cabbage-mosaic viruses and the cabbage black-ring virus." (Tompkins 1939)

Literature:

Chaté, E., fils. Culture pratique des giroflées des divers modes d'essimplage. 95 pp. Paris. 1867

Gigante, R. Il mosaico della violaciocca. R. Staz. Patol. Veg. Roma Boll. (n.s.) 16: 166-174. 1936.

Noble, R. J., Hynes, H. J., McCleery, F. C., and Birmingham, W. A. Plant diseases recorded in New South Wales. N. S. Wales Dept. Agric. Sci. Bull. 46. 47 pp. 1934.

Smith, K. M. Colour changes in wallflowers and stocks. Gard. Chron. III, 98: 112. 1935

__________ The virous diseases of glasshouse and garden plants. Sci. Hort. 4: 126-140. 1936.

__________ Matthiola virus 1. In A textbook of plant virus diseases. London 1937. p. 18-21.

Tompkins, C. M. Breaking in stock (Matthiola incana), a virosis. Phytopath. 24: 1137. 1934. (Abst.).

__________ Two mosaic diseases of annual stock. Journ. Agr. Res. 58; 63-77. 1939

MATTHIOLA-SEVERE-MOSAIC VIRUS

Name:

Synonyms:

Common name: Matthiola-severe-mosaic virus

Geographic distribution: California

Host range: CHENOPODIACEAE--*Chenopodium album* L., *Spinacia oleracea* L. CRUCIFERAE--*Brassica alba* (L.) Boiss., *B. kaber* (DC.) L. C. Wheeler (*B. arvensis* (L.) Ktze.), *B. nigra* (L.) Koch., *B. rapa* L., *Capsella bursa-pastoris* (L.) Medik., *Hesperis matronalis* L., *Matthiola incana* (L.) R.Br. var. *annua*(L.) Voss., *M. bicornis* (Sibth. & Sm.) DC. RESEDACEAE---*Reseda odorata* L. SOLANACEAE--*Nicotiana tabacum* L., *Petunia hybrida* Vilm.

Symptoms: In annual stocks, coarse very conspicuous chlorotic mottling in leaves, very coarse breaking of flower color in all but white and yellow varieties. In *Nicotiana tabacum*, necrotic local lesions. No infection in *Chenopodium murale*, *Alyssum maritimum*, *Brassica adpressa*, *B. juncea*, *B. pekinensis*, *Cheiranthus cheiri*, *Lunaria annua*, *Malcomia maritima*, *Nicotiana langsdorffii*, or *N. glutinosa*.

Methods of transmission: By sap (symptoms after about 14 days). Not by seed. By *Brevicoryne brassicae* (L.), *Lipahis pseudobrassicae* (Davis), *Myzus persicae* (Sulz.).

Properties: Thermal inactivation point near 60°C. Dilution tolerance 1:3000. Withstands aging in vitro between 7 and 8 days at 22°C.

Remarks:
Failure to infect kale, Brussels sprounts, cabbage, cauliflower, sprouting broccoli, kohlrabi, and rape, characterizes both Matthiola severe mosaic and Matthiola mild mosaic, and serves tc distinguish these viruses from certain other crucifer viruses (Tompkins 1939).

Literature:

Tompkins, C. M. Two mosaic diseases of annual stock. Journ. Agric. Res. 58: 63-77. 1939.

NARCISSUS-MOSAIC VIRUS

Name:

Synonyms: Narcissus yellow stripe (virus) Darlington 1908
Narcissus gray disease (virus) McKay 1926
Bulb plant mosaic virus Atanasoff 1928 (In part)
Narcissus gray disease virus McWhorter 1932

Narcissus mosaic virus McWhorter and Weiss 1932
Narcissus stripe-disease virus Caldwell et al 1938, 1943. (In part)

Common name: Narcissus-mosaic virus

Geographic distribution: Widespread—Australia (Buckland 1906), England (Darlington 1908), Bermuda (Ogilvie 1928), Bulgaria and Holland (Atanasoff 1928), Japan (Fukushi 1932), United States.

Host range: AMARYLLIDACEAE—*Narcissus* spp. and hybrids.

Symptoms: Dwarfing and reduced yield. In leaves systemic chlorotic streaking, pale green, grayish, or yellow; in some varieties (King Alfred) necrotic streaking; malformation and epidermal roughening. In flowers opaque, frost-like streaks and blotches, sometimes malformation.—Haasis 1939.

Methods of transmission: By bulb grafting (Van Slogteren 1938, Haasis 1939, Caldwell and Prentice 1943). By sap (McWhorter 1932, Van Slogteren 1938, Haasis 1939, Caldwell and Prentice 1943). By the aphids *Anuraphis roseus* (Baker), *Aphis rumicis* L., *Macrosiphum* (*Illinoia*) *solanifolii* (Ashm.), *M. pisi* (Kalt.), *M. rosae* (L.), *Myzus cerasi* (F.), and *M. convolvuli* (Kalt.) (Blanton and Haasis 1942). Not through seed or through soil (Haasis 1939, Caldwell and Prentice 1943). Possibly by root contact (McWhorter 1932, Hawker 1943). Symptoms appear in the season following inoculation.

Properties: Thermal inactivation point 70° to 75°C. Dilution end-point between 1:100 and 1:200. Resists aging for 72 hours at 21° to 24°C. Does not pass Pasteur-Chamberland filters L_2, L_5, or L_7. —Haasis 1939.

Remarks:

Smith's (1937) treatment of narcissus-mosaic virus as a synonym of Tulipa virus 1 on the strength of Atanasoff's (1928) meager data is not justified by more recent work of Haasis (1939) and Caldwell and Prentice (1943), which indicates this virus is restricted to *Narcissus*.

McWhorter and Weiss (1932) and Caldwell and James (1938) suggested that more than one virus is involved in narcissus mosaic, but more recent cross-inoculations by Haasis (1939) and by Caldwell and Prentice (1943) indicate that the symptoms of narcissus mosaic, including the leaf proliferations, are caused by a single virus.

Literature:

Atanasoff, D. Mosaic disease of flower bulb plants. Bull. Soc. Bot. Bulgarie 2: 51-60. 1928.

Blanton, F. S., and Haasis, F. A. Transmission of the narcissus mosaic virus by aphids. Journ. Econ. Entomol. 32: 469-470. 1939.

____________, and ____________ Three additional species of aphids transmitting narcissus mosaic. Journ. Econ. Entomol. 33: 942. 1940.

Blanton, F. S., and Haasis, F. A. Insect transmission of the virus causing narcissus mosaic. Journ. Agr. Res. 65: 413-419. 1942.

Buckland, L. Daffodil yellow-stripe diseases. Garden 70: 52. 1906.

Caldwell, J. "Stripe" disease of narcissus. Nature 142: 441. 1938.

____________, and James, A. L. An investigation into the "stripe" disease of narcissus. I. The nature and significance of the histological modifications following infection. Ann. Appl. Biol. 25: 244-253. 1938.

____________, and Prentice, I. W. An investigation into the "stripe" disease of narcissus. II. Experiments on the virus agent and its spread. Ann. Appl. Biol. 30: 27-32. 1943.

Darlington, H. R. Yellow-stripe in daffodils. Journ. Roy. Hort. Soc. 34: 161-166. 1908.

Fukushi, T. A contribution to our knowledge of virus diseases of plants in Japan. Trans. Sapporo Nat. Hist. Soc. 12: 130-141. 1932.

Haasis, F. A. Studies on narcissus mosaic. New York Cornell Agric. Exp. Sta. Memoir 224: 1-22. 1939.

Hawker, Lilian E. Experiments on the rate of spread of narcissus stripe in the field. Ann. Appl. Biol. 30: 184-185. 1943.

McKay, M. B. Narcissus and tulip diseases. Oregon State Hort. Soc. Ann. Rept. 18: 137-149. 1926.

McWhorter, F. P. Narcissus "gray disease" is a transmissible mosaic. Florists' Exch. 79 (14): 11. 1932.

______________ Narcissus-mosaic symptoms. Phytopath. 22: 998. 1932. (Abst.).

______________ The symptoms of narcissus mosaic developed within the plant. Phytopath. 25: 896-897. 1934. (Abst.).

______________, and Weiss, F. Diseases of narcissus. Oregon Agric. Exp. Sta. Bull. 304: 5-41. 1932.

Ogilvie, L. Virus diseases of plants in Bermuda. Bermuda Dept. Agric. Bull. 7 (8): 4-7. 1928.

Slogteren, E. van. The transmission of virus diseases in daffodills. Chronica Botanica 4: 205. 1938.

Smith, K. M. A textbook of plant virus diseases. London 1937. p. 414.

NARCISSUS-WHITE-STREAK VIRUS

Name:

Synonyms: Narcissus silver streak (virus) Chittenden 1933
Narcissus white streak (virus) McWhorter 1938

Common name: Narcissus-white-streak virus

Geographic distribution: Widespread. England and Holland (Chittenden 1933), United States.

Host range: AMARYLLIDACEAE—*Narcissus* spp. and hybrids.

Symptoms: In leaves narrow dark green streaks becoming prominent as white, gray, or yellowish white streaks after the flowering period. Similar streaks in flower stems (Haasis 1939). Early maturity, with purple or white streaking (McWhorter 1938).

Methods of transmission: By sap (Haasis 1939), symptoms in the season following inoculation. By *Aphis rumicis* L. and *Macrosiphum* (*Illinoia*) *solanifolii* (Ashm) (Blanton 1939).

Properties: Not determined.

Remarks:

The white streaks are dead areas of sunken epidermal or chlorenchyma cells, whereas the yellow streaks of narcissus mosaic are overgrowths of living cells (McWhorter 1939). White-streaking symptoms are expressed at temperatures in excess of 65°F, and become more conspicuous after flowering (Haasis 1939), whereas mosaic mottling tends to be less distinct after flowering (McWhorter and Weiss 1932).

Literature:

Blanton, F. S. Aphid transmission of the virus causing white streak of narcissus. Journ. Econ. Entomol. 32: 726-727. 1939.

Chittenden, F. J. Mosaic disease of narcissi. Roy. Hort. Soc. Daffodil Yearbook 1933: 72-73. 1933.

Haasis, F. A. White streak, a virus disease of narcissus. Phytopath. 29: 890-895. 1939.

McWhorter, F. P. Narcissus mosaic and early maturity. U. S. Bur. Plant Indus. Plant Disease Reporter 22: 147-148. 1938.

______________ The white streak or white stripe disease of narcissus. Phytopath. 29: 826. 1939. (Abst.).

______________ The distribution of zilverblad or white streak in narcissus plantings on the West Coast. U. S. Bur. Plant Indus. Plant Disease Reporter 24: 20-24. 1940.

______________, and Weiss, F. Diseases of narcissus. Oregon State Coll. Agr. Exp. Sta. Bull. 304: 5-41. 1932.

(NERIUM) OLEANDER-VARIEGATION VIRUS

Name:

Synonyms: Oleander variegation (virus) Guicciardi 1831

Common name: Oleander-variegation virus.

Geographic distribution: Italy.

Host range: APOCYNACEAE—*Nerium oleander* L.

Symptoms: Leaf variegation.

Methods of transmission: By grafting (Guicciardi 1831).

Properties: Not determined.

Remarks:

Original report by Guicciardi (1831) has not been seen but according to Moretti (1841) and Atanasoff (1935), variegation was transmitted to green oleander by grafting.

Literature:

Atanasoff, D. Old and new virus diseases of trees and shrubs. Phytopath. Zeitschr. 8: 197-223. 1935.

Guicciardi, Hyacinthi. De nonnullus physiologico-botanicis animadversionibus quae retrogradum lymphae vegetabilis motum respiciunt. (Dissertationes Ticinenses praeside Guiseppe Moretti). Ticini, typ. Fusi. 22 p. 1831.

Moretti, G. Isis von Oken 1841: 584. 1841.

ORNITHOGALUM-MOSAIC VIRUS

Name: _Marmor scillearum_ Smith & Brierley 1944

Synonyms: Bulb-plant-mosaic (virus) Atanasoff 1928 (in part)
Ornithogalum-mosaic virus Smith & Brierley 1944

Common name: Ornithogalum-mosaic virus.

Geographic distribution: United States, Holland? Probably general.

Host range: LILIACEAE--_Galtonia candicans_ Decne., _Hyacinthus orientalis_ L., _Lachenalia_ sp., _Ornithogalum thyrsoides_ Jacq., (?_Eucomis undulata_ Ait.).

Symptoms: Mild green mottling in leaves, blotching in flower stalks, thin streaks in perianth segments.

Methods of transmission: By sap (with difficulty). By _Aphis gossypii_ Glover, _Macrosiphum lilii_ Monell, _M. solanifolii_ Ashm., _Myzus circumflexus_ Buckt., _M. persicae_ Sulz. Not through seed.

Properties: Not determined.

Remarks:

Allium cepa L., _Lilium formosanum_ Stapf, _L. longiflorum_ Thunb. are insusceptible.

Literature:

Atanasoff, D. Mosaic disease of flower bulb plants. Bul. Soc. Bot. Bulgarie 2: 51-60. 1928.

Smith, Floyd F., and Brierley, P. Ornithogalum mosaic. Phytopath. 34: 1944 (in press).

(PAEONIA) PEONY-MOSAIC VIRUS

Name: *Paeonia Virus 1* (Dufrenoy) Smith 1937
Peony mosaic disease (virus) Whetzel 1915

Synonyms: Peony infectious chlorosis virus Fukushi 1932
Peony-ringspot virus Green 1935
Peony mosaic virus Guterman 1935

Common name: Peony-mosaic virus.

Geographic distribution: Canada (Coulson), Denmark, England (Green), France, Japan (Fukushi), United States.

Host range: RANUNCULACEAE--*Paeonia* sp. SOLANACEAE--*Nicotiana tabacum* L., *Petunia* sp. (Dufrenoy 1934).

Symptoms: In *Paeonia*, yellow rings, irregular patches or mottle, occasionally small necrotic spots (illustrated by Green, Guterman). In *Nicotiana tabacum*, necrotic primary spots, followed by necrosis along petioles and stems, with dwarfing and death of the plant (Dufrenoy 1934). In *Petunia*, dwarfing and mosaic (Dufrenoy 1934).

Methods of transmission: By sap, peony to tobacco and petunia (Dufrenoy 1934).

Properties: Not determined.

Remarks:
Peony mosaic is widespread, but the only claim of transmission is that by Dufrenoy (1934) who states that sap inoculations from the chlorotic areas induced symptoms in tobacco and petunia, but similar inoculations from adjacent green areas did not.

Literature:
Coulson, J. G. Peony diseases. Rept. Quebec Soc. Prot. Plants 15 (1922-23): 67-70. 1923.
Dufrenoy, J. Un virus des Renonculacées transmissible au *Nicotiana tabacum*. Compt. rend. Soc. Biol. Paris 117: 346-348. 1934.
Fukushi, T. A contribution to our knowledge of virus diseases of plants. Trans. Sapporo Nat. Hist. Soc. 12: 130-141. 1932.
(Gram, E., et al.) Plantessygdommer i Danmark 1932. Oversigt, samlet ved Statens plantepatologiske Forsøg. Tidsskr. for Planteavl. 39: 453-506. 1933. (RAM 13: 151. 1934).
Green, D. E. A suspected virus disease of Paeonies new to Great Britain. Gard. Chron. 98: 213. 1935.
Guterman, C. E. F. Peony diseases. In Cornell Agric. Ext. Bull. 321: 32-43. 1935.
Smith, K. M. A textbook of plant virus diseases. London 1937. p. 5
Whetzel, H. H. Diseases of the peony. Trans. Mass. Hort. Soc. 1915 (1): 103-112.

PASSIFLORA-FRUIT-WOODINESS VIRUS

Name: Marmor passiflorae Holmes 1939
Passiflora Virus 1 (Noble) K. M. Smith 1937

Synonyms: Passion fruit woodiness (virus) Cobb 1901
Passion fruit bullet disease virus Noble 1928

Common name: Passiflora-fruit-woodiness virus

Geographic distribution: Australia, England (?) (Bewley 1923), Kenya (?) (Storey 1940).

Host range: PASSIFLORACEAE--Passiflora coerulea L., P. edulis Sims

Symptoms: In Passiflora edulis, leaves dwarfed, curled, deformed, with yellowish chlorosis or light and dark green mottling; stems mottled; fruits dwarfed, misshapen or spherical, their surface often cracked and sometimes exhibiting irregular protrusions, characteristically firm, with a tough rind due to thickening and lignification of the cell walls of the pericarp. Symptoms are more severe in cooler months.

Methods of transmission: By sap (Noble 1928).

Properties: Not reported.

Literature:

Bewley, W. F. Mycological Report. Eighth Ann. Rep. Cheshunt Exper. and Res. Sta. Herts. (1922): 34-45. 1923.

Cobb, N. A. Woodiness of passion fruit. Agr. Gaz. New South Wales 12: 407-418. 1901.

Holmes, F. O. Handbook of phytopathogenic viruses. Minneapolis 1939. p. 77-78.

Noble, R. J. Some observations on the woodiness or bullet disease of passion fruit. Journ. & Proc. Roy. Soc. New South Wales 62: 79-98. 1928

__________ Woodiness of the passion fruit. Cause of the disease discovered. Agr. Gaz. New South Wales 39: 681-683. 1928.

Smith, K. M. A textbook of plant virus diseases. London 1937. p. 51.

Storey, H. H. Plant Pathology. E. Afr. Agric. Res. Sta., Amani, Ann. Rept. 1939: 8-11. 1940

PASSIFLORA-VARIEGATION VIRUS

Name:

Synonyms:

Common name: Passiflora-variegation virus

Geographic distribution: England, France

Host range: PASSIFLORACEAE—*Passiflora quadrangularis aucubaefolia*, *P. kermesina* Link & Otto (*P. raddiana*), *P. vitifolia* HBK., *P.* Impératrice Eugénie (a supposed hybrid of *P. coerulea*)(Lemoine 1875).

Symptoms: Leaf variegation.

Methods of transmission: By grafting (Bradley 1717, 1726, Lemoine 1875).

Properties: Not determined.

Literature:

Atanasoff, D. Old and new virus diseases of trees and shrubs. Phytopath. Zeitschr. 8: 197-223. 1935.

Bradley, R. New improvements of planting and gardening. 2: 129. (London ?) 1717. (Cited by Atanasoff)

__________ A generale treatise on husbandry and gardening. 1: 282, 283; 2: 129. London 1726. (Cited by Atanasoff).

Lemoine, M. (Reviewed in Gard. Chron. n.s. 3: 81. 1875).

PELARGONIUM-LEAF-CURL VIRUS

Name: *Pelargonium Virus 1* (Pape) Smith 1937

Synonyms: Pelargonium curl disease (virus ?) Pape 1927
Geranium-mosaic virus Verplancke 1932
Geranium crinkle virus Jones 1938
Geranium leaf-curl virus Jones 1940

Common name: Pelargonium-leaf-curl virus

Geographic distribution: Belgium, Canada, Czechoslovakia, England, Germany, United States.

Host range: GERANIACEAE—*Pelargonium hederaceum*, *P. hortorum* Bailey, *P. zonale* (L.) Soland.

Symptoms: Pale chlorotic leaf-spots, becoming bright yellow stellate or dendritic blotches, finally necrotic. Leaves crinkled, dwarfed. Symptoms are more intense under hot, dry conditions, but often mask on further growth (Pethybridge & Smith 1932). Symptoms mask in summer (Jones).

Methods of transmission: By grafting (Pethybridge & Smith 1932, Verplancke 1932, Berkeley 1938, Jones 1940). Symptoms after 28-40 days (Pethybridge & Smith 1932, Jones 1940). Not by sap (Pethybridge & Smith 1932, Verplancke 1932, Bremer 1933, Jones 1940). Not through soil (Verplancke 1932). Not through seed (Jones 1940).

Properties: Not determined.

Remarks:

Pelargonium leaf-curl appears to be a distinctive virus disease. Additional symptom types in *Pelargonium* are described by Pape (1928), Verplancke (1932), Bremer (1933), Blattný (1933), and Jones (1940). See also Pelargonium-mosaic virus. Verplancke (1932) reports sap transmission of a *Pelargonium* virus to tobacco, and production of symptoms in *Pelargonium* with "mosaic of tobacco."

Literature:

Berkeley, G. H. Leaf curl of Geranium. Canad. Hort. (Floral ed.) 61: 108. 1938

Blattný, C. Virové choroby Pelargonií. Ochrana Rostlin 13: 145. 1933. (RAM 13: 378)

Bremer, H. Zur Kräuselkrankheit der Pelargonien. Blumen u. Pflanzenb. 48: 32-33. 1933.

Jones, L. K. Crinkle and mosaic of geranium. Phytopath. 28: 11. 1938 (Abst.)

__________ Leaf curl and mosaic of geranium. Washington Agric. Expt. Sta. Bull. 390. 19 pp. 1940.

Pape, H. Das verheerende Auftreten der Kräuselkrankheit bei Pelargonien. Die Gartenwelt 31: 329-331. 1927.

______ Eine Begleiterscheinung bei der Kräuselkrankheit der Pelargonien. Gartenw. 32: 116-117. 1928.

Pethybridge, G. H., and Smith, K. M. A suspected virus disease of zonal Pelargoniums. Gard. Chron. 92: 378=379. 1932.

Pirone, P. P. Geranium crinkle in New Jersey. U. S. Bur. Plant Indus. Plant Disease Reporter 22: 146. 1938.

__________ Leaf crinkle of geranium. U. S. Bur. Plant Indus. Plant Disease Reporter 24: 129-131. 1940.

Smith, K. M. A textbook of plant virus diseases. London 1937. p. 48.

__________ The virus diseases of glasshouse and garden plants. Sci. Hort. 4: 126-140. 1936.

S(orauer), P(aul). Die Kräuselkrankheit bei den Pelargonien. Zeitschr. Pflanzenkr. 26: 193-194. 1916.

Verplancke, G. Une maladie à virus filtrant du "Pelargonium zonale." Bul. Cl. Sci. Acad. Roy. de Belgique. Sér.5, 18: 269-281. 1932.

PELARGONIUM-MOSAIC VIRUS

Name:

Synonyms: Geranium-mosaic virus Jones 1938

Common name: Pelargonium-mosaic virus

Geographic distribution: United States and Canada (Jones 1940), Czechoslovakia (Blattný 1933).

Host range: GERANIACEAE--*Pelargonium hortorum* Bailey

Symptoms: Light and dark green mottling in leaves, the pale areas usually large, irregular, and interveinal. Dwarfing. Symptoms mask in summer. (Jones)

Methods of transmission: By grafting, symptoms after 28 to 40 days. Not by sap. Not through seed. (Jones 1940).

Properties: Not determined.

Remarks:
Symptoms similar to Jones' (1940) Pelargonium mosaic are described by Pape (1928), Verplancke (1932), and Blattný (1933), but no sound inferences can be drawn as to the synonymy of the viruses concerned. Verplancke (1932) distinguishes leaf curl, interveinal mosaic, and oily spot symptoms, but implies that these are merely phases of one disease, as all three classes produced similar symptoms on graft transfers. Blattný (1933) distinguishes aucuba mosaic and interveinal chlorosis, the latter transmissible by grafting. Jones (1940) considers Blattný's interveinal chlorosis similar to his geranium mosaic.

Literature:

Blattný, C. Virové choroby Pelargonií. Ochrana Rostlin 13: 145. 1933. (RAM 13: 378)

Jones, L. K. Crinkle and mosaic of geranium. Phytopath. 28: 11. 1938. (Abst.)

__________ Leaf curl and mosaic of geranium. Washington Agric. Exp. Sta. Bull. 390. 19 pp. 1940.

Pape, H. Ein Begleiterscheinung bei der Kräuselkrankheit der Pelargonien. Gartenwelt 32: 116-117. 1928.

Verplancke, G. Une maladie à virus filtrant du "Pelargonium zonale." Bul. Cl. Sci. Acad. Roy. de Belgique. Sér. 5, 18: 269-281. 1932.

PEPEROMIA-RINGSPOT VIRUS

Name:

Synonyms:

Common name: Peperomia-ringspot virus

Geographic distribution: Illinois.

Host range: PIPERACEAE--Peperomia obtusifolia A. Dietr.

Symptoms: Plants are stunted, leaves distorted and disfigured by systemic chlorotic or brown necrotic rings.

Methods of transmission: By grafting. No insect vector is known.

Properties: Not determined.

Literature:

Creager, D. B. Ring spot of popular Peperomias caused by virus. Flor. Rev. 87 (2256): 15-16. 1941.

PETUNIA-MOSAIC VIRUS

Name:

Synonyms:

Common name: Petunia-mosaic virus

Geographic distribution: Japan, United States.

Host range: SOLANACEAE--Lycopersicon esculentum Mill., Nicotiana alata Link & Otto (N. affinis), X N. sanderae W. Wats., N. tabacum L., Petunia sp. (Matsumoto & Hirane 1939). Nicotiana glauca Graham, N. glutinosa L., N. rustica L., Petunia violacea Lindl., Physalis pubescens L., Solanum nigrum L. PHYTOLACCACEAE --Phytolacca decandra L. (Johnson 1926)

Symptoms: In Petunia, clearing of veins in the incipient stage, followed by light and dark green mottling, and often blistering or savoying. Mild mottling in other hosts listed. No cellular inclusions are formed. (Matsumoto & Hirane 1939).

Methods of transmission: By sap.

Properties: Withstands dilution 1:50, not 1:100. Filterable through Berkefeld N filters. Apparently unable to produce antiserum in rabbits; serologically unrelated to tobacco-mosaic virus (Matsumoto & Hirane 1939).

Remarks:

Of two strains of petunia mosaic found in Taihoku, one is identical with tobacco-mosaic virus, the other, described here, is serologically distinct, lacks inclusion bodies, and is considered similar to the petunia mosaic of Hoggan (1927), which lacked intracellular inclusions (Matsumoto and Hirane 1939). Hoggan states that her petunia mosaic is that described by Johnson (1926).

Literature:

Hoggan, Isme A. Cytological studies on virus diseases of Solanaceous plants. Journ. Agric. Res. 35: 651-671. 1927.

Johnson, J. Mosaic diseases on differential hosts. Phytopath. 16: 141-149. 1926.

Matsumoto, T. Differentiation of two Petunia mosaic diseases by means of serological, cytological, and inoculation experiments. Bot. & Zool. 3 (5): 893-898. 1935. (Japanese) (RAM 14: 699).

____________, and Hirane, S. Two strains of Petunia mosaic. Trans. nat. Hist. Soc. Formosa 29 (184-185): 1-12. 1939.

PHLOX-STREAK VIRUS

Name:

Synonyms:

Common name: Phlox-streak virus

Geographic distribution: Canada (New Brunswick).

Host range: POLEMONIACEAE--*Phlox* sp.

Symptoms: Faint vein-clearing. Severe necrosis of the collenchyma in veins and petioles, with distortion of the leaf-blades. Streaking in leaves and stems.

Methods of transmission: By grafting. Not by sap.

Properties: Not determined.

Literature:

McLeod, D. J. *In* Conners, I. L. Twenty-first Ann. Rept. Canadian Plant Disease Survey, 1941 xviii + 102 pp. 1942. p. 96

PHYTOLACCA-MOSAIC VIRUS

Name:

Synonyms: Pokeweed mosaic virus Allard 1918
Phytolacca decandra mosaic virus Fernow 1925

Common name: Phytolacca-mosaic virus.

Geographic distribution: United States

Host range: PHYTOLACCACEAE--*Phytolacca decandra* L.

Symptoms: Mosaic mottling, sometimes leaf distortion also (Allard 1918). Intracellular inclusions are occasional (Smith 1926).

Methods of transmission: By sap (Allard 1918, Fernow 1925, Johnson 1930). Not through seed (Allard 1918). Symptoms in 12 to 15 days (Allard 1918).

Properties: Not determined.

Remarks:

Phytolacca decandra is susceptible to other viruses, but the virus commonly occurring in this species is non-transmissible to tobacco or to other solanaceous plants (Allard 1918, Fernow 1925, Johnson 1930)

Literature:
Allard, H. A. The mosaic disease of Phytolacca decandra. Phytopath. 8: 51-54. 1918.
Fernow, K. H. Interspecific transmission of mosaic diseases of plants. New York Cornell Agr. Exp. Sta. Memoir 96: 3-34. 1925.
Johnson, E. M. Virus diseases of tobacco in Kentucky. Kentucky Agr. Exp. Sta. Bull. 306: 289-415. 1930.
Smith, Fanny F. Some cytological and physiological studies of mosaic diseases and leaf variegations. Ann. Missouri Bot. Gard. 13: 425-484. 1926.
Woods, A. F. Observations on the mosaic disease of tobacco. U. S. Dept. Agr. Bur. Plant Indus. Bull. 18. 24 pp. 1902. Pl. II.

PITTOSPORUM-VARIEGATION VIRUS

Name:

Synonyms:

Common name: Pittosporum-variegation virus

Geographic distribution: California, France

Host range: PITTOSPORACEAE--Pittosporum daphniphylloides Hayata, P. tobira Dryand.

Symptoms: Dwarfing; systemic chlorotic mottling and distortion of leaves (Milbrath). Yellow variegation (Carrière).

Methods of transmission: By grafting(Carrière). By patch bark graft (Milbrath).

Properties: Not determined.

Remarks:
Carrière reports two instances in which scions of the yellow-variegated Pittosporum tobira variegatum set in the green variety transmitted variegation to the stocks although the buds died. The symptoms of Milbrath's virus disease (illustrated) seem distinct from Carrière's, but the two are grouped pending more complete data.

Literature:
Carrière, E. A. Influence du greffon sur le sujet. Revue Horticole 59: 58-59. 1887.
Milbrath, D. G. Probable virus disease of Pittosporum daphniphylloides. California Dept. Agr. Bull. 29: 158-159. 1940.

PRIMULA-MOSAIC VIRUS

Name:

Synonyms: *Primula obconica* mosaic virus Tompkins & Middleton

Common name: Primula-mosaic virus

Geographic distribution: United States (California).

Host range: PRIMULACEAE—*Primula malacoides* Franch., *P. obconica* Hance, *P. sinensis* Lindl.

Symptoms: Prominent leaf mottling, with irregular dark green islands on light green to yellow ground, upward cupping, distortion, and sometimes shoestring effects in leaves. Conspicuous breaking in petal color; mottling of the calyx. Leaves, flowers, petioles, and peduncles reduced in size, with severe general stunting.

Methods of transmission: By sap (symptoms after 16 to 21 days). No vector is known. Not through seed.

Properties: Thermal inactivation point between 48° and 50°C. Resists aging 24 hours, not 48 hours, at 22°C. Dilution tolerance 1:10.

Remarks:

In parallel trials distinct from cucumber-mosaic virus in symptom expression in *Primula*, and in host range. No infection in 46 species representing 42 genera in 23 families, except in the 3 *Primula* spp. listed. Repeated efforts to infect tobacco failed. *Myzus persicae* failed to transmit this virus. The many other references to mosaic in *Primula* cited by Tompkins and Middleton cannot be assigned to this virus on the information available.

Literature:

Tompkins, C. M., and Middleton, John T. A mosaic disease of *Primula obconica* and its control. Journ. Agr. Res. 63: 671-679. 1941.

PRUNELLA-MOSAIC VIRUS

Name:

Synonyms:

Common name: Prunella-mosaic virus

Geographic distribution: Finland.

Host range: LABIATAE—*Prunella vulgaris* L.

Symptoms: Yellowish-green mosaic spotting, malformation, and dwarf-

ing in leaves; plants often die prematurely.

Methods of transmission: By sap. By aphids (undetermined). Not through seed. (Symptoms after 1 to 2 months or longer).

Properties: Not determined.

Remarks:

Aphids from various Compositae and from Lathyrus transmitted the virus, but aphids from Silene and from Apium did not. The author considers several species of aphids were effective as vectors, but only mass cultures were tested, and no aphids are named.

Literature:

Liro, J. I. Über die Mosaikkrankheit der Prunella vulgaris. Ann. Soc. Zool.-Bot. Fenn. Vanamo, 11: 143-149. 1930.

(PRUNUS) FLOWERING-CHERRY-ROUGH-BARK VIRUS

Name: Rimocortium Kwanzani Milbrath & Zeller

Synonyms: Prunus virus 9 Milbrath & Zeller

Common name: Flowering-cherry-rough-bark virus

Geographic distribution: Oregon.

Host range: ROSACEAE--Prunus serrulata Lindl. var. Kwanzan. Mazzard (P. avium L.) seedlings can carry the virus without symptoms.

Symptoms: Dwarfing, with few lateral branches and short internodes. Bark roughened by longitudinal splitting. Leaves crowded together, arched downward by defective development of the midribs, which often show longitudinal and transverse cracking.

Methods of transmission: By budding.

Properties: Not determined.

Literature:

Milbrath, J. A., and Zeller, S. M. Rough-bark, a virus disease of flowering cherry. Phytopath. 32: 428-430. 1942.

PTELEA-VARIEGATION VIRUS

Name:

Synonyms: Ptelea infectious chlorosis (virus) Baur 1907

Common name: Ptelea-variegation virus

Geographic distribution: Germany

Host range: RUTACEAE--*Ptelea trifoliata* L.

Symptoms: Green and yellow leaf variegation

Methods of transmission: By grafting (Baur) and by budding (Reuter).

Properties: Not determined.

Remarks:
The ornamental variety *Ptelea trifoliata foliis variegatis* is affected with this virus disease, but the *aurea* form is not (Baur 1907), but Reuter (1870) reported an *aurea* form transmissible.

Literature:

Baur, E. Über infektiöse Chlorosen bei *Ligustrum*, *Laburnum*, *Fraxinus*, *Sorbus* und *Ptelea*. Bericht. d. Deutsch. Bot. Gesellsch. 25: 410-413. 1907.

Reuter. Die Resultate verschiedener Veredlungsarten. Botaniker Zeitung 28: 641-644. 1870.

RHAMNUS-VARIEGATION VIRUS

Name:

Synonyms:

Common name: Rhamnus-variegation virus

Geographic distribution: France.

Host range: RHAMNACEAE--*Rhamnus* sp. ("Alaterne").

Symptoms: White variegation.

Methods of transmission: By grafting.

Properties: Not determined.

Remarks:
Carrière grafted a white variegated buckthorn on a green stock. Although the graft failed, a bud of the stock 8 to 10 cm. below the graft expressed variegation like the scion variety.

Literature:

Carrière, E. A. Influence du greffon sur le sujet. Revue Horticole 59: 58-59. 1887.

ROBINIA (LOCUST)-BROOMING VIRUS

Name: *Chlorogenus robiniae* Holmes 1939
Robinia Virus 1 (Hartley & Haasis) Smith 1937

Synonyms: Locust witches' broom (virus) Waters 1898
Black locust brooming disease (virus) Hartley & Haasis 1929

Common name: Robinia (locust)-brooming virus

Geographic distribution: United States--Pennsylvania to Georgia and west to Arkansas (Grant et al. 1942). A similar disease occurs in Germany (Ross 1933).

Host range: LEGUMINOSAE--Robinia pseudo-acacia L.

Symptoms: Proliferation of lateral buds into "brooms" of upright or ascending habit, common on sprouts from roots or stumps, also found on branches of large trees. Brooms often die in winter (Hartley & Haasis 1929). Vein-clearing in leaflets is characteristic of early stages; leaflets are greatly reduced in size and tapered at the base in acute brooming. Petioles are shorter, leaves fall prematurely. Roots are brittle, tend to broom also (Grant, Stout, and Ready 1942.)

Methods of transmission: By grafting (symptoms after 5 months) (Jackson & Hartley 1933). By grafting or budding. Not by sap. (Grant, Stout, and Ready 1942.)

Properties: Not determined.

Remarks:

Symptomless carriers are sometimes induced to develop brooming symptoms when cut back or defoliated (Grant 1939). A similar disease of Gleditsia triacanthos L. is mentioned by Grant and Hartley (1938) but is not reported transmissible.

Literature:

Grant, T. J. Systemic brooming of Robinia pseudoacacia and other virus-like diseases of trees. Phytopath. 29: 8. 1939 (Abst.

__________, and Hartley, C. A witches' broom on black locust and a similar disease on honey locust. U. S. Bur. Plant Indus. Plant Disease Reporter 22: 28-31. 1938.

__________, Stout, D. C., and Ready, J. C. Systemic brooming, a virus disease of black locust. Journ. For. 40: 253=260. 1942.

Hartley, C., and Haasis, F. W. Brooming disease of black locust (Robinia pseudoacacia). Phytopath. 19: 163-166. 1929.

__________, and Jackson, L. W. R. A brooming disease of Robinia pseudoacacia transmitted by grafts. Phytopath. 23: 13. 1933. (Abst.).

Holmes, F. O. Handbook of phytopathogenic viruses. Minneapolis 1939. p. 13-14.

Jackson, L. W. R., and Hartley, C. Transmissibility of the brooming disease of black locust. Phytopath. 23: 83-90. 1933.

Ross, H. Über nichtparasitäre Hexenbesen an Robinia pseudoacacia L. Ber. d. Deutsch. Bot. Gesellsch. 51: 292-300. 1933.

Smith, K. M. A textbook of plant virus diseases. London 1937. p. 184.

Waters, C. E. Witches' broom on the locust. Plant World 1: 83-84. 1898.

(ROSA) ROSE-MOSAIC VIRUS

Name: Rosa Virus 1 (White) Smith 1937
Marmor rosae Holmes 1939

Synonyms: Rose infectious chlorosis virus White 1928
Rose mosaic virus Weiss & McWhorter 1930

Common name: Rose-mosaic virus

Geographic distribution: United States, England (Smith 1937), Brazil (Kramer 1940, 1940a), Bulgaria (Christoff 1935), France (Vibert 1863).

Host range: ROSACEAE--Rosa canina L., R. eglanteria L. (R. rubiginosa L.) (Vibert 1863), R. gallica L. (Christoff 1935), R. hugonis Hemsl., R. multiflora Thunb., R. nutkana Presl, R. odorata Sweet, R. wichuraiana Crép., Rosa hybrids.

Symptoms: Chlorotic areas feathering away from the midribs of leaflets, often associated with local distortion, also ring, oakleaf, and watermark patterns. Yellow mosaics are characterized by brighter and lighter yellow patterns.

Methods of transmission: By grafting, budding. Not by sap. No vector is known.

Properties: Not determined.

Remarks:
Thomas & Massey (1939) distinguish rose mosaics 1, 2, and 3, of which the first is White's rose mosaic or Rosa Virus 1 (White) Smith 1937, Marmor rosae Holmes 1939. Rose mosaics 2 and 3 are yellow mosaics, separable on the basis of symptom expression in the test varieties Hollywood, Belle of Portugal, and Souvenir de Claudius Pernet. Symptoms were induced in apple with rose mosaic 3 only. Kramer (1940a) has described a yellow mosaic of rose from Saõ Paulo. Brierley and Smith (1940) found no duplicates among 5 collections of yellow mosaic compared on 5 test varieties of rose. The name Rosa virus 2 (Brierley) Smith 1937 is based on these. Evidently a number of strains of rose yellow mosaics could be distinguished on the basis of varietal reactions. However, these may be regarded as strains of rose-mosaic virus, until further information is available. The relation to rose mosaic of Vibert's (1863) variegation of 'Eglantier' (Rosa eglanteria L.), Christoff's (1935) mosaic of R. gallica L., transmissible to apple and pear, and Blattný's (1938) vein mosaic of R. canina, cannot be determined from the evidence available.

Literature:

Baker, K. F., and Thomas, H. Earl. The effect of temperature on symptom expression of a rose mosaic. Phytopath. 32: 321-326. 1942.

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Johnson, E. M., and Valleau, W. D. The ring symptom of virus diseases in plants. Kentucky Agr. Exp. Sta. Bul. 361: (239)-263. 1935.

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Newton, W. Infectious chloroses of the rose. Rep. Dominion Bot. 1930. Div. Bot., Canada Dept. Agric. p. 23. 1931.

Smith, K. M. A textbook of plant virus diseases. London 1937. p. 152-154.

Thomas, H. Earl, and Massey, L. M. Mosaic diseases of the rose in California. Hilgardia 12: 647-663. 1939.

Vibert, M. Observations relatives à l'influence qu' exerce la greffe sur le sujet. Journ. Soc. Imp. et Cent. Hort. 9: 144-145. 1863.

Weiss, F., and McWhorter, F. P. Pacific Coast survey for rose mosaic. U. S. Bur. Plant Indus. Plant Disease Reporter 14: 203-205. 1930.

White, R. P. An infectious chlorosis of roses. U. S. Bur. Plant Indus. Plant Disease Reporter 12: 33-34. 1928.

__________ An infectious chlorosis of rose. Phytopath. 20: 130. 1930. (Abst.).

__________ Chloroses of the rose. Phytopath. 22: 53-69. 1932.

__________ The effect of mosaic on bloom production of the Talisman rose. Phytopath. 24: 1124. 1934.

(ROSA) ROSE-STREAK VIRUS

Name: Rosa Virus 4 (Brierley) Smith 1937
Marmor veneniferum Holmes 1939

Synonyms: Rose streak virus Brierley 1935

Common name: Rose-streak virus

Geographic distribution: United States--District of Columbia, Maryland, New York, Texas, Virginia.

Host range: ROSACEAE—Rosa canina L., R. multiflora Thunb., R. nutkana Presl, R. wichuraiana Crép., Rosa hybrids.

Symptoms: Brown rings, brown or yellowish vein-banding in leaves; brownish or greenish ring marking in canes of systemically invaded roses.

Methods of transmission: By grafting, budding. Not by sap. No insect vector is known. Not through seed.

Properties: Not determined.

Literature:

Brierley, P. Streak, a virus disease of roses. Phytopath. 25: 7-8. 1935. (Abst.).
__________, and Smith, Floyd F. Mosaic and streak diseases of rose. Journ. Agric. Res. 61: 625-660. 1940.
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Holmes, F. O. Handbook of phytopathogenic viruses. Minneapolis 1939. p. 75.
Smith, K. M. A textbook of plant virus diseases. London 1937. p. 155-156.

(ROSA) ROSE-WILT VIRUS

Name: Rosa Virus 3 (Grieve) Smith 1937
Marmor flaccumfaciens Holmes 1939

Synonyms: Rose wilt or die-back virus Grieve 1931
Rose wilt virus Grieve 1942

Common name: Rose-wilt virus

Geographic distrition: Australia, New Zealand (Grieve 1931a), Italy (Gigante 1936).

Host range: ROSACEAE—Rosa hybrids.

Symptoms: Young leaves recurved, crowded, brittle. Defoliation progressing from the tips of stems downward, followed by die-back of the stem tips, and darkening of the bases of young stems. Intracellular inclusions present (Gigante 1936, Grieve 1942).

Methods of transmission: By sap (Grieve 1931, Gigante 1936). By budding (Grieve 1931a). Possibly by aphis (Grieve 1931). By Macrosiphum sp. (Gigante 1936). Symptoms after 10 to 20 days (Grieve 1931a).

Properties: Passes Seitz filter that retains Bacillus pyocyaneus (Grieve 1931). Gives no precipitin reaction (Mushin 1942).

Remarks:

Gigante (1936) distinguished his virus from rose-wilt virus by the characters (1) blackish-brown spots and light brown necrotic areas in leaves, (2) flower deformations, (3) necrosis of medullary rays, (4) intracellular bodies in leaves, and (5) transmissibility by aphids. Grieve has subsequently (1942) shown that points (3) and (4) apply also to rose-wilt virus, while a single transfer for which he did not claim significance (1931) indicated aphid transmission also.

Literature:

Gigante, R. Una nuova virosi della rosa in Italia. Boll. R. Staz. Pat. veg. N.S. 16: 76-94. 1936. (RAM 16: 179-180. 1937).

Grieve, B. J. "Rose wilt" and "die-back". A virus disease of roses occurring in Australia. Austral. Journ. Exp. Biol. and Med. Sci. 8: 107-121. 1931.

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Holmes, F. O. Handbook of phytopathogenic viruses. Minneapolis 1939. p. 73-74.

Mushin, Rose. Serological studies on plant viruses. Austral. Journ. Exp. Biol. and Med. Sci. 20: 59-63. 1942. (RAM 21: 425).

Smith, K. M. A textbook of plant virus diseases. London 1937. p. 154-155.

(RUMEX) DOCK-MOSAIC VIRUS

Name:

Synonyms: *Rumex obtusifolius* mosaic virus Fernow 1925
Dock infectious chlorosis virus Grainger 1929

Common name: Dock-mosaic virus

Geographic distribution: England, United States.

Host range: POLYGONACEAE--*Rumex lanceolatus* Thunb., *R. obtusifolius* L.

Symptoms: In *Rumex obtusifolius*, fine regular mottling (Fernow); diffuse yellowish-green mottling figured by Grainger. No conspicuous stunting or other effects except leaf mottling. Chlorotic areas sometimes confined to interveinal spaces, sometimes in large patches, the two types apparently distinct (Grainger).

Methods of transmission: By sap (Fernow, Grainger).

Properties: Not determined.

Remarks:
The viruses studied by Fernow and Grainger appear to be the same or similar, from the limited data published. Fernow found no other plants susceptible among many tested.

Literature:

Fernow, K. H. Interspecific transmission of mosaic diseases of plants. New York Cornell Agric. Exp. Sta. Mem. 96: 3-34. 1925.

Grainger, J. An infectious chlorosis of the dock. Proc. Leeds Phil. & Lit. Soc., Sci. Sect. 1: 360. 1929.

(SAMBUCUS) ELDER-MOSAIC VIRUS

Name:

Synonyms:

Common name: Elder-mosaic virus

Host range: CAPRIFOLIACEAE--Sambucus nigra L., S. canadensis L.

Geographic distribution: Czechoslovakia, Germany, Denmark, United States (Martin 1925).

Symptoms: Leaves show a dark yellowish-green veining. Plants are dwarfed with few, mostly sterile flowers.

Methods of transmission: By Aphis sambuci (Blattný).

Properties: Not determined.

Literature:

Blattný, C. Poznámky o virových a příbuzných chorobách rostlin. I. (Notes on virus and similar diseases of plants I.) Ochrana Rostlin 10: 130-138. 1930. (RAM 10: 328-329. 1931).

(Gram, E., et al.) Plantesygdommer i Danmark 1932. Oversigt, samlet ved Statens plantepatologiske Forsøg. Tidsskr. for Planteavl. 39: 453-506. 1933. (RAM 13: 151. 1934).

Martin, G. H. Diseases of forest and shade trees, ornamental and miscellaneous plants in the United States in 1924. U. S. Bur. Plant Indus. Plant Disease Reporter Suppl. 42: 313-380. 1925.

Smith, K. M. A textbook of plant virus diseases. London 1937. p. 556.

(SENECIO) CINERARIA-STREAK VIRUS

Name:

Synonyms:

Common name: Cineraria-streak virus Jones 1942

Geographic distribution: United States.

Host range: COMPOSITAE--*Senecio cruentus* (Mass.) DC.
SOLANACEAE--*Lycopersicon esculentum* Mill.

Symptoms:

Methods of transmission: By sap to tomato. By seed.

Properties: Not reported.

Remarks:
Jones (1942) reports 2 virus diseases of Cineraria, mosaic and streak, are often carried in the seed, and that the streak virus is mechanically transmissible to tomato.

Literature:

Jones, L. K. Virous diseases of Cineraria. *In* Fifty-second Annual Report for the fiscal year ended June 30, 1942. Washington Agric. Exp. Sta. Bull. 425: 73-74. 1942.

SORBUS-VARIEGATION VIRUS

Name: *Pyrus Virus 1* (Baur) Smith 1937

Synonyms: Infectious chlorosis Baur 1907
Infectious chlorosis Hertzsch 1930
Pyrus variegation virus Atanasoff 1935

Common name: Sorbus-variegation virus

Geographic distribution: Germany.

Host range: ROSACEAE--*Sorbus aucuparia* L. (*Pyrus aucuparia*)

Symptoms: Yellow or white variegation, sometimes vein-clearing and vein-banding (Smith).

Methods of transmission: By grafting.

Properties: Not determined.

Literature:

Atanasoff, D. Old and new virus diseases of trees and shrubs. Phytopath. Zeitschr. 8: 97-223. 1935

Baur, E. Über eine infektiöse Chlorosen bei *Ligustrum*, *Laburnum*, *Fraxinus*, *Sorbus* und *Ptelea*. Ber. d. Deutsch. Bot. Gesellsch. 25: 410-413. 1907.

_______ Beiträge zur infektiöse Chlorose. Zeitschr. f. Bot. 20: 65-86. 1927.

Hertzsch, W. Infektiöse Chlorose. Der Züchter 2 (8): 195-198. 1930.

Smith, K. M. A textbook of plant virus diseases. London 1937. p. 149

TABEBUIA-WITCHES'-BROOM VIRUS

Name:

Synonyms:

Common name: Tabebuia-witches'-broom virus.

Geographic distribution: Puerto Rico

Host range: BIGNONIACEAE--*Tabebuia pallida* (Lindl.) Miers

Symptoms: Brooming--numerous shoots with short internodes, thickened nodes, and small leaves. Few flowers are developed, and the broomed shoots die prematurely.

Methods of transmission: By budding. Not by sap. No insect vector is known. Not through seed.

Properties: Not determined.

Literature:

Cook, M. T. The witches' broom of *Tabebuia pallida* in Puerto Rico. Journ. Agric. Univ. Puerto Rico 22: 441-442. 1938.

Smith, K. M. A textbook of plant virus diseases. London 1937. p. 558.

(TULIPA) TULIP-BREAKING VIRUS

Names: *Tulipa virus 1* (Cayley) Smith 1937 (emended Brierley and Smith 1944).
Marmor tulipae Holmes 1939 (emended Brierley and Smith 1944).

Synonyms: Tulip breaking (virus) Griffiths and Juenemann 1919
Tulip breaking virus McKay 1926
Flower bulb mosaic disease virus Atanasoff 1928 (in part)
Tulip breaking (virus) Cayley 1928a, 1928b
Tulip breaking virus McKay, Brierley and Dykstra 1929
Tulip breaking virus McKenny Hughes 1930
Mosaique des Tulipes virus Dufrenoy 1931
Tulip breaking virus Cayley 1932
Tulip breaking virus McWhorter 1932.
Variegatura del tulipano Gigante 1938
Tulip breaking virus Brierley and McKay 1938
Tulip white break (virus) McKenny Hughes 1931
Tulip clear break (virus) Cayley 1932
Tulip full break, clotted break (viruses) McKenny Hughes 1934
Tulip virus I (color removing) McWhorter 1934, 1938
Marmor mite Holmes 1939

Tulip red break (virus) McKenny Hughes 1931
Tulip self break (virus) Cayley 1932
Tulip self break (virus) McKenny Hughes 1934
Tulip virus II (color adding) McWhorter 1934, 1938
Marmor tulipae Holmes 1939
Lilium auratum mosaic virus Guterman 1928 (?)
Lily mosaic virus Guterman 1930 (in part)
Lilium speciosum mosaic virus Tasugi and Ikeno 1935 (?)
Lily latent virus McWhorter 1937
Easter lily strong mottle virus Brierley 1939
Tulip virus (in lily) Brierley 1940
Lily mosaic virus Gadd and Loos 1940 (in part ?)
Lily mottle viruses Brierley and Smith 1944a

Common name: Tulip-breaking virus

Geographic distribution: Widespread in tulip. Allied types widespread in lilies.

Host range: LILIACEAE—Tulipa gesneriana L., T. clusiana DC., T. eichleri Regel, T. greigi Regel, T. linifolia Regel (Cayley 1932); Lilium auratum Lindl. (Guterman 1928); L. longiflorum Thunb. (Ogilvie and Guterman 1929); Fritillaria sp., Lilium canadense L., L. speciosum Thunb., L. superbum L., L. tigrinum Ker-Gawl. (Guterman 1930); L. candidum L. (McWhorter 1937); L. formosanum Stapf (Brierley 1939); L. amabile Palib., L. bulbiferum L. subsp. croceum (Chaix) Baker, L. cernuum Komarov, L. chalcedonicum L., L. dauricum Ker-Gawl., L. elegans Thunb., L. giganteum Wall., L. henryi Baker, L. leucanthum Baker, L. myriophyllum Franch. var. superbum (Baker) Wils., L. regale Wils., L. sargentiae Wils., L. tenuifolium Fisch. (L. pumilum DC)., L. testaceum Lindl., L. umbellatum Hort. (Brierley 1940); Calochortus sp., Fritillaria pudica (Pursh) Spreng., Zigadenus fremontii (Torr.) S. Wats. (Brierley and Smith 1944a). One lily virus strain affects Ornithogalum thyrsoides Jacq., but no hosts outside Liliaceae are recognized by Brierley and Smith (1944a). Other species of Lilium reported susceptible to "lily mosaic" by various writers are probably susceptible to a virus of the tulip-breaking group, but cucumber-mosaic virus may be involved also in such reports.

Symptoms: In tulips, "breaking" of the flower color in the form of striping, flaming, or feathering. In the "average break" characteristic of commercial Rembrandt tulips both intensification and bleaching of the anthocyanic pigment appear in different areas. In "self breaks" (color-adding, Tulip virus 2) this pigment is intensified in stripes. In "full break" (color removing, Tulip virus 1) this pigment is removed from some areas, exposing the ground color of the flower, which is white or yellow according to the variety (Cayley 1928, Longley 1935, McWhorter 1938a). White- and yellow-flowered varieties do not break unless some trace of anthocyanin pigment is present. Some dark red varieties develop "self breaks" even when infected with color removing virus (McWhorter 1938a,b).

Tulip leaves are mottled by Tulip virus 1 and some lily virus strains, but not by Tulip virus 2. The chlorotic areas contain small chloroplasts poor in chlorophyll (Dufrenoy 1931, Gigante 1938). Inclusion bodies are present (Gigante 1938, McWhorter 1938a, 1940), but characterize Tulip virus 1 and are lacking in Tulip virus 2 infections (McWhorter 1938a).

In Easter lily, mottling with distortion, mottling only, or no symptoms according to the strain of the virus involved. In Lilium formosanum severe or mild mottling. In L. tigrinum mild mottling, soon masked, or yellowing and death from certain strains. In other Lilium spp., mottling usual, necrosis and death occasional. (Brierley and Smith 1944a.) Inclusion bodies occur in some species of Lilium (Tasugi and Ikeno 1935), but apparently not in all (Gadd and Loos 1940). Inclusion bodies induced in tulips serve to distinguish certain lily strains of the virus (McWhorter 1940).

Methods of transmission: By bulb grafting (Cayley 1928). By sap (Atanasoff 1928, McKay et al. 1929). By Anuraphis (Aphis) tulipae B. de Fonsc. (McKenny Hughes 1934). By Aphis fabae Scop. and A. gossypii Glover (Brierley and Smith 1944a). By Macrosiphum solanifolii Ashm. (=M. gei Koch, = Illinoia solanifolii Ashm.) and Myzus persicae Sulz. (McKenny Hughes 1930, 1931, 1934, Brierley and McKay 1938), possibly by Myzus circumflexus (Buckt.) (Brierley and McKay 1938) and Myzus solani (Kalt) (= M. pelargonii Sulz.) (McKay et al. 1929). Not through seed. Symptoms after 11 to 38 days in tulips inoculated in early stage of growth, or in second season if inoculated late (Brierley and Smith 1944a).

Properties: Determined in tulip, thermal inactivation point between 65° and 70°C, infectious in dilutions up to 1:100,000, withstands drying in leaves 11 days, resistant to alcohol (McWhorter 1935). Properties of Tulip virus 1 and 2 are the same (McWhorter 1938).

Determined in Lilium formosanum, physical properties vary with the different strains: thermal inactivation points between 60° and 65°C (or 55° and 60°C), dilution end points 1:10,000 (or 1:10), withstands aging at 18°C 6 days (or 4 days), infectious after drying on cloth for 6 hours (or less than 2 hours) (Brierley and Smith 1944a).

Remarks:

According to Hoog (1933) the transmissibility of tulip breaking by bulb grafting was known to Dutch bulb growers as early as 1637. Blagrave (quoted by McKay and Warner 1933) gave directions for inducing breaking by bulb grafting in 1675. Breaking patterns are recognizable in illustrations published as early as 1576 (McKay and Warner 1933).

Color-removing and color-intensifying variants of the usual breaking pattern in tulips were described by Cayley (1932) and by McKenny Hughes (1934). McWhorter (1934, 1938) noted that these sub-types tend to segregate in the vegetative increase of inoculated tulips. He obtained relatively pure strains of color-adding virus (Tulip Virus 2) and color-removing virus (Tulip Virus 1) from such segregates, and termed them "antithetic viruses" because of their contrasting effects in tulips. The

physical properties of these two viruses, determined in tulips, are identical (McWhorter 1935); but, determined in Lilium formosanum, they differ slightly (Brierley and Smith 1944a). Holmes (1939) gave the name Marmor tulipae to McWhorter's Tulip virus 2, and Marmor mite to McWhorter's Tulip virus 1 and Lily latent virus (McWhorter 1937).

Lily-mosaic virus (Guterman 1928, 1930) was first considered distinct, but later reduced to synonymy with cucumber-mosaic virus by Price (1937) whose interpretation was accepted by Smith (1937) and gained wide usage. It has been subsequently shown (Brierley 1939, 1940) that cucumber-mosaic virus is less prevalent in lilies than viruses of the tulip-breaking type, and that cucumber-mosaic virus is important in lilies chiefly as an essential constituent of the necrotic-fleck complex in Lilium longiflorum (Brierley and Smith 1944b). The mottling viruses thus far studied in lilies appear to be sufficiently close to the classical tulip-breaking virus to fall in the same virus species (Brierley and Smith 1944a).

Literature:

Atanasoff, D. Mosaic disease of flower bulb plants. Bull. Soc. Bot. Bulgarie 2: 51-60. 1928

Brierley, P. Two distinct viruses from the mosaic complex in Lilium longiflorum. Phytopath. 29: 3. 1939. (Abst.).

__________. Prevalence of cucumber and tulip viruses in lilies. Phytopath. 30: 250-257. 1940.

__________. Current season development of virus symptoms in tulips. Phytopath. 31: 838-843. 1941.

__________, and McKay, M. B. Experiments with aphids as vectors of tulip breaking. Phytopath. 28: 123-129. 1938.

__________, and Smith, Floyd F. Studies on lily virus diseases: the mottle group. Phytopath. 34: 1944 (a) (in press).

__________, and __________ Studies on lily virus diseases: the necrotic fleck complex in Lilium longiflorum. Phytopath. 34: 1944 (b) (in press).

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__________ "Breaking" in tulips. Ann. Appl. Biol. 15: 529-539. 1928 (b).

__________ "Breaking" in tulips II. Ann. Appl. Biol. 19: 153-172. 1932.

Dufrenoy, J. Mosaique des tulipes. Compt. rend. Soc. Biol. 108: 51-53. 1931.

__________ Die Viruskrankheiten. Phytopath. Zeitschr. 5: 85-90. 1932.

Gadd, C. H. and Loos, C. A. Lily mosaic. Trop. Agric. Ceylon 94: 160-167. 1940.

Gigante, R. La variegatura del tulipano. Boll. R. Staz. Patol. Veg. Roma 18 (n.s.): 429-454. 1938.

Griffiths, D., and Juenemann, H. E. Commercial Dutch-bulb culture in the United States. U. S. Dept. Agric. Bull. 797. 50 pp. 1919.

Guterman, C. E. F. A preliminary report on mechanical transmission of the mosaic of Lilium auratum. Phytopath. 18: 1025-1026. 1928.

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Holmes, F. O. Handbook of phytopathogenic viruses. Minneapolis 1939. p. 52-54

Hoog, J. The breaking of tulips. Gard. Chron. 94: 471. 1933

Longley, L. E. Flower color in "broken" or mosaic tulips. Proc. Amer. Soc. Hort. Sci. 33: 674-677. 1935.

McKay, M. B. Narcissus and tulip diseases. Ann. Rept. Oregon State Hort. Soc. 18: 137-150. 1926.

__________, Brierley, P., and Dykstra, T. P. Tulip "breaking" is proved to be caused by mosaic infection. U. S. Dept. Agric. Yearbk. 1928: 596-597. 1929.

__________, and Warner, M. E. Historical sketch of tulip mosaic or breaking, the oldest known plant virus disease. Nat. Hort. Mag. 12: 179-216. 1933.

McKenny-Hughes, A. W. Aphis as a possible vector of "breaking" in tulip species. Ann. Appl. Biol. 17: 36-42. 1930.

__________ Aphides as vectors of "breaking" in tulips. Ann. Appl. Biol. 18: 16-29. 1931.

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McWhorter, F. P. A preliminary analysis of tulip breaking. Phytopath. 22: 998. 1932. (Abst.).

__________ The properties and interpretation of tulip-breaking viruses. Phytopath. 25: 898. 1935. (Abst.).

__________ A latent virus of lily. Science 86: 179. 1937.

__________ The antithetic virus theory of tulip-breaking. Ann. Appl. Biol. 25: 254-270. 1938 (a).

__________ Correlation between self-breaking and blue nuclei among certain commercial tulip varieties. Science 88: 411. 1938 (b).

__________ Separation of Tulip 1 virus from lily-latent by cytological methods. Phytopath. 30: 788. 1940. (Abst.).

Ogilvie, L., and Guterman, C. E. F. A mosaic disease of the Easter lily. Phytopath. 19: 311-315. 1929.

Pape, H. Die Mosaikkrankheit der Lilien. Gartenwelt 37: 324-325, 364. 1933.

Price, W. C. Classification of lily mosaic virus. Phytopath. 27: 561-569. 1937.

Smith, K. M. A textbook of plant virus diseases. London 1937. 410-415.

Tasugi, H., and Ikeno, S. On the intracellular bodies associated with the mosaic disease of the lily (Preliminary report). Ann. Phytopath. Soc. Japan 5: 30-43. 1935. (Japanese-English resume).

(ULMUS) ELM-MOSAIC VIRUS

Name:

Synonyms: (?) Elm mottle mosaic virus (Blattný 1938)
Elm mosaic virus (Swingle, Tilford, and Irish 1941)

Common name: Elm-mosaic virus

Geographic distribution: Bulgaria (Atanasoff 1935), Czechoslovakia (Blattný 1938), England (Swailes 1887), United States (Swingle, Tilford, and Irish 1941).

Host range: ULMACEAE--*Ulmus americana* L., *U. campestris* L. (Swailes 1887), *U. glabra* Huds., *U. pumila* L. (Rankin 1931).

Symptoms: Yellow and green mottling, rugosity, distortion of leaves. Slight brooming of branches. Brittleness of branches. Some leaf buds may fail to expand, leaving intervals of bare branches and a tufted aspect. (Swingle, Tilford, and Irish 1941, 1943.)

Methods of transmission: By grafting (Swailes 1887). By patch-bark grafts. Not by sap. Not by root grafts. (Swingle, Tilford, and Irish 1941, 1943.) Symptoms in the following season.

Properties: Not determined.

Remarks:
The variegation in *Ulmus campestris* that Swailes (1887) illustrated and transmitted by grafting may differ from the mosaic of *U. americana* of Swingle et al. (1941, 1943). Swingle et al. (1943) cite no other authors. Evidence of natural spread in Ohio is reported.

Literature:

Atanasoff, D. Old and new virus diseases of trees and shrubs. Phytopath. Zeitschr. 7: 197-223. 1935.

Blattný, C. Poznámka o méně známých virových chorobách. Ochrana Rostlin 14 (55): 86-87. 1938. (RAM 17: 543).

Rankin, W. H. A new disease of elm. Seventh. Natl. Shade Tree Conf., Proc. Ann. Meeting 1931, pp. 79-82. 1931.

Swailes, G. The influence of scion on stock. Gard. Chron. III, 2: 284, 368. 1887.

Swingle, R. U., Tilford, P. E., and Irish, C. F. A transmissible mosaic of American elm. Phytopath. 31: 22. 1941. (Abst.)

__________, __________, and __________ A graft transmissible mosaic of American elm. Phytopath. 33: 1196-1200. 1943. illus.

(ULMUS) ELM-PHLOEM-NECROSIS VIRUS

Name:

Synonyms: Elm phloem necrosis virus Swingle 1938

Common name: Elm-phloem-necrosis virus

Geographic distribution: United States.

Host range: ULMACEAE--*Ulmus americana* L., possibly *U. fulva* Michx.

Symptoms: General aspect of sparse foliage on upper and outer branches. Leaves drooping, lateral margins curled upward, later yellowish-green to yellow, finally dropping or drying in place. Phloem necrosis in roots and lower trunk, yellow to yellowish-brown at first, later dark brown with the odor of wintergreen. Occasionally fatal in 3 or 4 weeks, usually fatal in 12 to 18 months. (Swingle 1942.)

Methods of transmission: By grafting. Not by sap. Not by soil. Symptoms in 6 to 24 months. (Swingle 1938, 1942.)

Properties: Not determined.

Literature:

Leach, J. G., and Valleau, W. D. Two reports on phloem necrosis of elm. U. S. Bur. Plant Indus. Plant Dis. Reporter 23: 300-301. 1939.

Swingle, R. U. A phloem necrosis of elm. Phytopath. 28: 757-759. 1938.

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ERRATA

On page 147, under Solanum tuberosum, Ditylenchus dipsaci and its synonym should be deleted. Heterodera rostochiensis is the nematode referred to in the report and this name should be substituted.

On page 232, in the table of contents, Arthur S. Rhoads should be cited as the author of the Florida report, instead of G. M. Stone as given.

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